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AFFDL-TR-77-101

COMPUTER PROGRAM FOR VIBRATION PREDICTION OF FIGHTER AIRCRAFT EQUIPMENTS

COMBINED ENVIRONMENTS TEST GROUP
ENVIRONMENTAL CONTROL BRANCH
VEHICLE EQUIPMENT DIVISION

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TECHNICAL REPORT AFFDL-TR-77-101
Final Report for Period 21 March 1976 to 15 April 1977

AIR FORCE FLIGHT DYNAMICS LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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ALAN H. BURKHARD, Ph.D., Tech Mgr
Combined Envts Test Group
Environmental Control Branch

WILLIAM C. SAVAGE
Chief
Environmental Control Branch

FOR THE COMMANDER

AMBROSE B. NUTT
Director
Vehicle Equipment Division
AF Flight Dynamics Laboratory

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This study details in-house efforts that culminate in a computer program for the prediction of vibration inputs to equipments mounted in fighter aircraft.

The computer format is orchestrated about a basic function whose thematic variations are invoked to describe boundary layer excitations and to synthesize a sequence of transfer functions whose operations, in turn, define

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the resultant vibration spectrum; beginning at the aircraft surface and proceeding inward to the designated equipment. Program inputs specify flight conditions, aircraft structural classes, equipment weight, equipment locational coordinates, and mounting categories in order to characterize vibration inputs of fighter aircraft equipments during flight attitudes ranging from straight and level states to a variety of significant flight maneuvers and phases. Program outputs, digital and graphical, are designed to provide the direct spectral information necessary to assemble sequential vibration histories corresponding to fighter aircraft mission profiles.

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FOREWORD

This joint report was prepared by the Vehicle Equipment Division, Air Force Flight Dynamics Laboratory (FEE) and by the ASD Computer Center (ADDS), Wright-Patterson Air Force Base, Ohio. The report contains the results of an in-house research program to develop a computer program for the utilization of a vibration prediction technique applied to equipments mounted in fighter aircraft.

This work was conducted from 21 March 1976 to 15 April 1977 under Task 61460412 with Robert W. Sevy as project engineer and under Problem Number D760078 with Mark N. Haller as mathematician.

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SYMBOLS

θ	angle (rads)
β	slope factor, low frequency rolloff
β'	slope factor, high frequency rolloff
α	form factor for low frequency rolloff segment of flex function
α'	form factor for high frequency rolloff segment of flex function
ω_o	locator frequency, low frequency rolloff (rads/sec)
$\omega_{o'}$	locator frequency, high frequency rolloff (rads/sec)
f_o	locator frequency, low frequency rolloff (Hz)
$f_{o'}$	locator frequency, high frequency rolloff (Hz)
f_x	frequency value at x (given f_o) (Hz)
$f_{x'}$	frequency value at x' (given $f_{o'}$) (Hz)
f_n	first fuselage bending mode, vertical, symmetric (Hz)
f_{2n}	second fuselage bending mode, vertical, symmetric (Hz)
f_c	center, or resonance frequency of Y(f)
a	acceleration, rms (ft/sec^2)
x	normalizing frequency ratio, low frequency rolloff; also aerodynamic distance downstream from A/C nose (ft)
x_E	aerodynamic distance downstream - from A/C nose to equipment location (ft)
x_{BT}	value of x to A/C mid chord at wing - fuselage junction (ft)
x_L, x_T	value of x to main landing gear strut (ft)
x'	normalizing frequency ratio, high frequency rolloff
I	integral of the flex function

SYMBOLS (CONTINUED)

δ_o	boundary layer thickness, zero altitude (ft)
δ_b	boundary layer thickness at altitude (ft)
H	altitude (ft)
C	speed of sound (ft/sec)
q	dynamic pressure (PSF)
U	free stream velocity (ft/sec)
M	mach number
ρ_o	density of air at zero altitude (slug/ft^3)
ρ	density of air at altitude (slug/ft^3)
P(f)	pressure spectral density (dynes/cm^2)^2/Hz
$\phi_n(x)$	normalized mode shape (fuselage)
L(f)	low frequency transfer function of primary structure
$L_m(f)$	maximum value of L(f)
M(f)	medium frequency transfer function of primary structure
$M_m(f)$	maximum value of M(f)
H(f)	high frequency transfer function of primary structure (aircraft skin)
G(f)	primary structure response, (g^2/Hz)
Y(f)	transfer function of equipments mounted on secondary structure
$Y_m(f)$	maximum value of Y(f)
$Y_{I(a)}$	Y(f) for equipment mounting category, I(a)
R(f)	response of secondary structure (g^2/Hz)
ε	load offset distance from maximum response location on secondary structure (in)

SYMBOLS (CONTINUED)

$R_{\varepsilon}(f)$	adjusted value of R(f) due to ε (g^2/Hz)
$S_{BT}(f)$	special function for the buffet turn flight phase
$P_{BT}(f)$	pressure spectral density spectrum of a fighter aircraft during buffet turn (PSF^2/Hz)
$S_T(f)$	special function for the takeoff phase
$P_T(f)$	equivalent pressure spectral density spectrum of an aircraft during the takeoff phase (PSF^2/Hz)
$S_L(f)$	special function of an aircraft during the landing phase
$P_L(f)$	equivalent pressure spectral density spectrum of an aircraft during the landing phase (PSF^2/Hz)
R_s	distance in from the skin (inches)
W_E	equipment weight (lbs)
W_s	surface density of skin (lbs/ft^2)
$P_m(f)$	maximum value of P(f) $(dynes/cm^2)^2$/Hz
$H_m(f)$	maximum value of H(f)
P_{mBT}	maximum value of P(f) during buffet turn $(dynes/cm^2)^2$/Hz
Re_x	$U\,x/\nu$ = Reynolds number at distance x
ν	kinematic viscosity at altitude (ft^2/sec)
m	modal mass (slugs)
E	Young's modulus (lbs/in^2)
I	plate moment of inertia ($bt^3/12$)
t	plate thickness (inches)
L	length of aircraft fuselage (inches)
λ	length of first bending mode, secondary structure (inches)
f_c	center frequency of transfer functions for equipment categories and of special functions

SYMBOLS (CONTINUED)

D_f	nominal fuselage diameter at $x = x_E$ (inches)
$L_M(f)$	maximum value of low frequency transfer function, first bending mode (dB)
$L_2(f)_M$	maximum value of low frequency transfer function, second bending mode (dB)

SECTION I

INTRODUCTION

From the equipment design and the functional test and analysis viewpoint, it is important that the predicted vibration spectra of fighter aircraft equipments emulate the real vibration histories as closely as the forecasting technology will allow. To do this, it is necessary to be able to portray the variform vibration spectra as the aircraft cycles through a variety of flight conditions, attitudes, and phases that, when seen in terms of their sequential assembly, constitutes a vibrational representation of the mission flight profile. Spectral fidelity is important not only from the viewpoint of the reversible*, functional failure -- a failure that underlines the interrelationship between the vibration spectral details and the concomittant equipment malfunction -- its importance is stressed again when vibration test inputs are chosen for the long-time test spectra associated with various reliability test philosophies. Here, premature fatigue failure often results because the vibration test spectrum exceeds the in situ spectrum; or more explicitly, fails to adequately mirror the real vibration environment relative to the spectral details, and to the real time of exposure.

1.0 Approach

The detailed development of the vibration prediction method utilized in this program is found in Reference 1. However, for review purposes, it is useful to briefly survey major elements of the technique.

* change the spectrum and the equipment resumes operation

1.1 Fuselage Vibration Behavior

The aircraft fuselage response is subdivided into three regimes: the low frequency region, dominated by the fuselage body bending modes; the medium frequency region, determined by the response of the internal structure; and the high frequency domain, which is established by the aircraft skin contributions. Three transfer functions L(f), M(f), and H(f) are assigned to these regions: low, medium, and high, respectively.

The boundary layer pressure spectral density P(f) is transferred through L(f), M(f), and H(f) to produce a structural response spectrum, G(f), which, in turn, is attenuated and further transformed by other functions as one progresses into the aircraft interior. P(f) and the three transfer functions are variants of the same basic function, the derivation of which is developed fully in Section II. Other special variants of this same function are employed to account for a variety of equipment mounting methods. A further variation is invoked to simulate a number of aircraft phases and maneuvers -- all are discussed in Section III and all are detailed in their applicable Appendices. Section III describes the computer program and its operating procedures, taken from the viewpoint of the user. Section IV demonstrates the applications of the prediction method and the program as it is applied to a number of aircraft equipment mounting methods and flight conditions. Appendix F contains the complete computer program in FORTRAN IV.

SECTION II

FLEX FUNCTION

1.0 Derivation

A rather detailed discussion of the flex function and its derivation is found in reference 1. But since we intend to expand on the earlier work and, moreover, since the function operates as the central mechanism of the computer program, a review of the main elements is essential.

Consider the following function and its mirror image:

$$\theta = \arctan A \tag{1}$$

$$\theta = \pi - \arctan A \tag{2}$$

where: θ = angle (rads)

$A = 2\beta(\omega/\omega_o)/1-(\omega/\omega_o)^2$

ω = angular frequency (rads/Hz)

ω_o, ω_o' = locator frequency (rads/Hz)

β, β' = slope factor

Equations (1) and (2) combine graphically to form a bandpass characteristic (Figure 1a). Equation (1) describes the low frequency roll-off; equation (2) the high frequency roll-off. Note that in this form, frequency translation occurs by control of $\omega_o(\omega_o')$. Slope control is readily obtained by adjustment of $\beta(\beta')$. These flexible

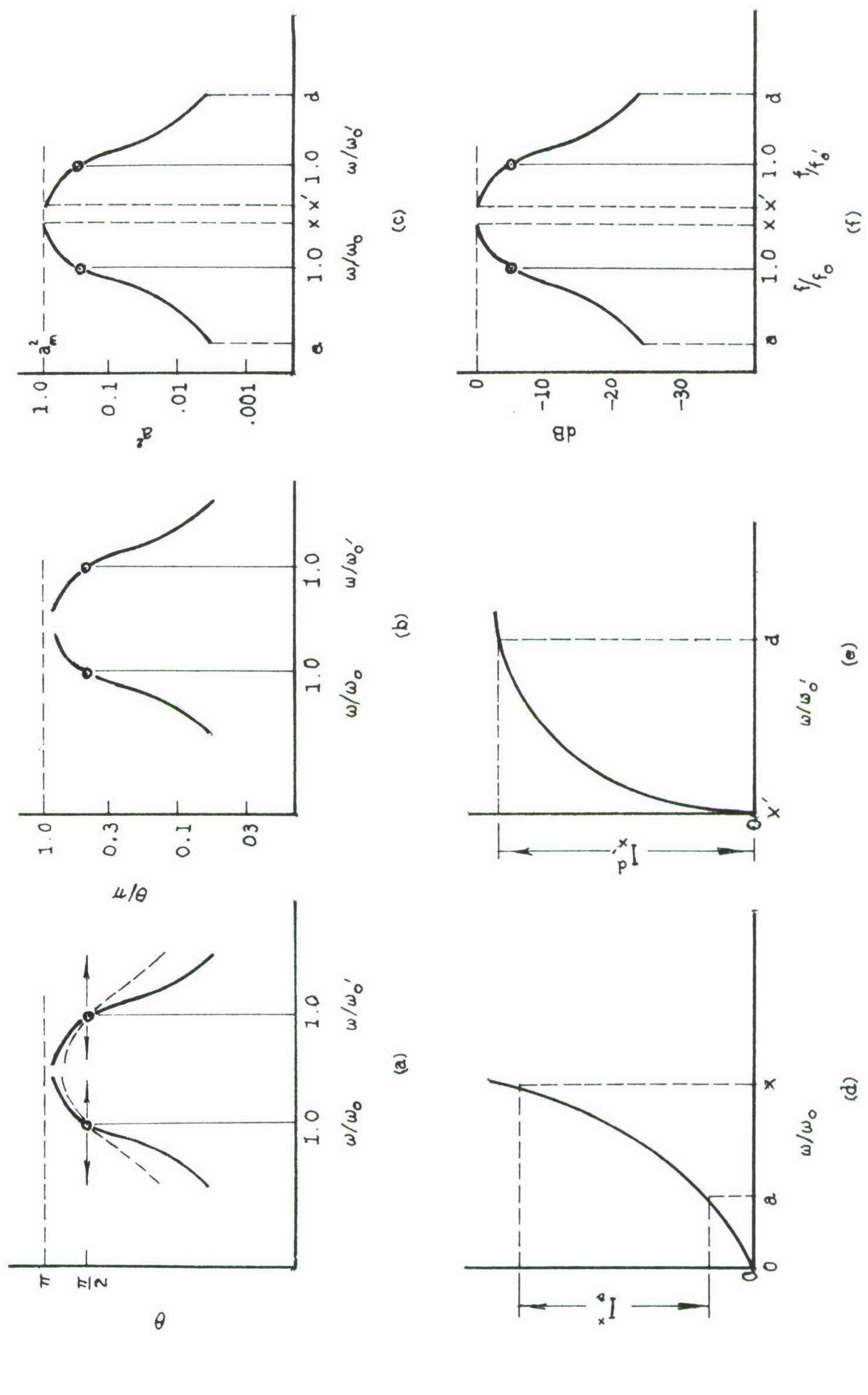


Figure 1. Derivation of the Flex Function and Associated Integral

and useful properties, by which response functions may be described using only four notations, will become more obvious a little later on.

1.1 Further Adjustments

However, there remains an objection to the curve in this form owing to the asymptotic properties of the function. That is, ω/ω_o must approach infinity in order that $\theta \rightarrow \pi$. Since π represents the curve maxima, and it is the maxima that we intend to reference when utilizing the functions, we must readjust the curves vertically to obtain a value of $\theta = \pi$ at a real, finite value of ω/ω_o. This we do as follows:

$$\theta/\theta_x = (\arctan A)/\theta_x \qquad (3)$$

$$\theta/\theta_{x'} = (\pi - \arctan A)/\theta_{x'} \qquad (4)$$

$$\text{where:} \quad \theta_x = \arctan\left[2\beta x/1-(x)^2\right]$$

$$\text{and:} \quad \theta_{x'} = \pi-\arctan\left[2\beta' x'/1-(x')^2\right]$$

The curves are now shown as Figure 1(b) and appear in normalized form, that is, the maximum value is unity at $\theta = \theta_x$ and $\theta = \theta_x'$.

We may let the functions represent a pertinent variable, say acceleration (a), by the following substitutions.

$$\text{Let:} \quad \theta/\theta_x = K\,a$$

$$\text{and:} \quad a = 1/K(\arctan A)/\theta_x \qquad (5)$$

$$\text{where:} \quad (\arctan A)/\theta_x = g(\omega/\omega_o)$$

when: $\omega = x\omega_o$, then $g(x) = 1.0$

and $a = a_{max}$

From inspection of (5), $1/K = a_{max}$. If we substitute this into (5), we have a generalized form for the independent variable, a:

$$a = a_{max}[(\arctan A)/\theta_x] \tag{6}$$

$$o \leq \omega/\omega_o \leq x$$

Operating similarly for the high frequency roll-off portion of the flex function we have:

$$a = a_{max} [(\pi - \arctan A)/\theta_{x'}] \tag{7}$$

$$x' \leq \omega/\omega_{o'}$$

A good deal of the time we will be concerned with mean squared values of the acceleration and the acceleration power spectral densities. Thus, (6) and (7) may be squared as follows:

$$a^2 = a^2_{max} [(\arctan A)/\theta_x]^2 \tag{8}$$

$$a^2 = a^2_{max} [(\pi - \arctan A)/\theta_{x'}]^2 \tag{9}$$

The squared curves are shown in Figure 1(c). When using power spectral densities, we will also be concerned with overall mean squared acceleration, thus the integrals of (8) and (9) appear as follows:

$$I_a^x = a^2_{max} \int_a^x [(\arctan A)/\theta_x]^2 d(\omega/\omega_o) \tag{10}$$

$$I_a^{x'} = a_{max}^2 \int_c^{x'} [(\pi - \arctan A)/\theta_{x'}]^2 \, d(\omega/\omega_{o'}) \qquad (11)$$

Figures 1(d) and (e) show the integrals of the low and high frequency curves, respectively. And since most of the time we will use the log of the independent variable a^2 (referred to a_{max}^2) we present (8) and (9) as follows:

$$dB = 10\log_{10}[(\arctan A)/\theta_x]^2 \qquad (12)$$

$$dB = 10\log_{10}[(\pi - \arctan A)/\theta_{x'}]^2 \qquad (13)$$

Also, since we will be using hertz for the frequency variable, we substitute f in lieu of ω and 180° for π. The final set of curves are shown in Figure 1(f).

2.0 Flex Function Display

Values of x and x´ were chosen for the low and high frequency functions as were values of β and β'. Since x and x´ represent the frequency ratios of the low and high frequency function at which normalization of the ordinate value occurs, they are identified, in truncated computerese, as NORM. FREQ. Both parametrics were selected to cover the range of vibration spectra that one associates with the primary structure of aircraft viewed over a wide range of structural locations and flight conditions. Figures 2 and 3 show a typical low and high frequency curve for x = NORM. FREQ. = 2.00 and x´ = NORM. FREQ. = 0.500, respectively. The $\beta(\beta')$ parameters are shown also on the figures as curve families having β and β' in the following graduations: 0.1, 0.2, 0.4, 0.6, 0.8 and 1.0.

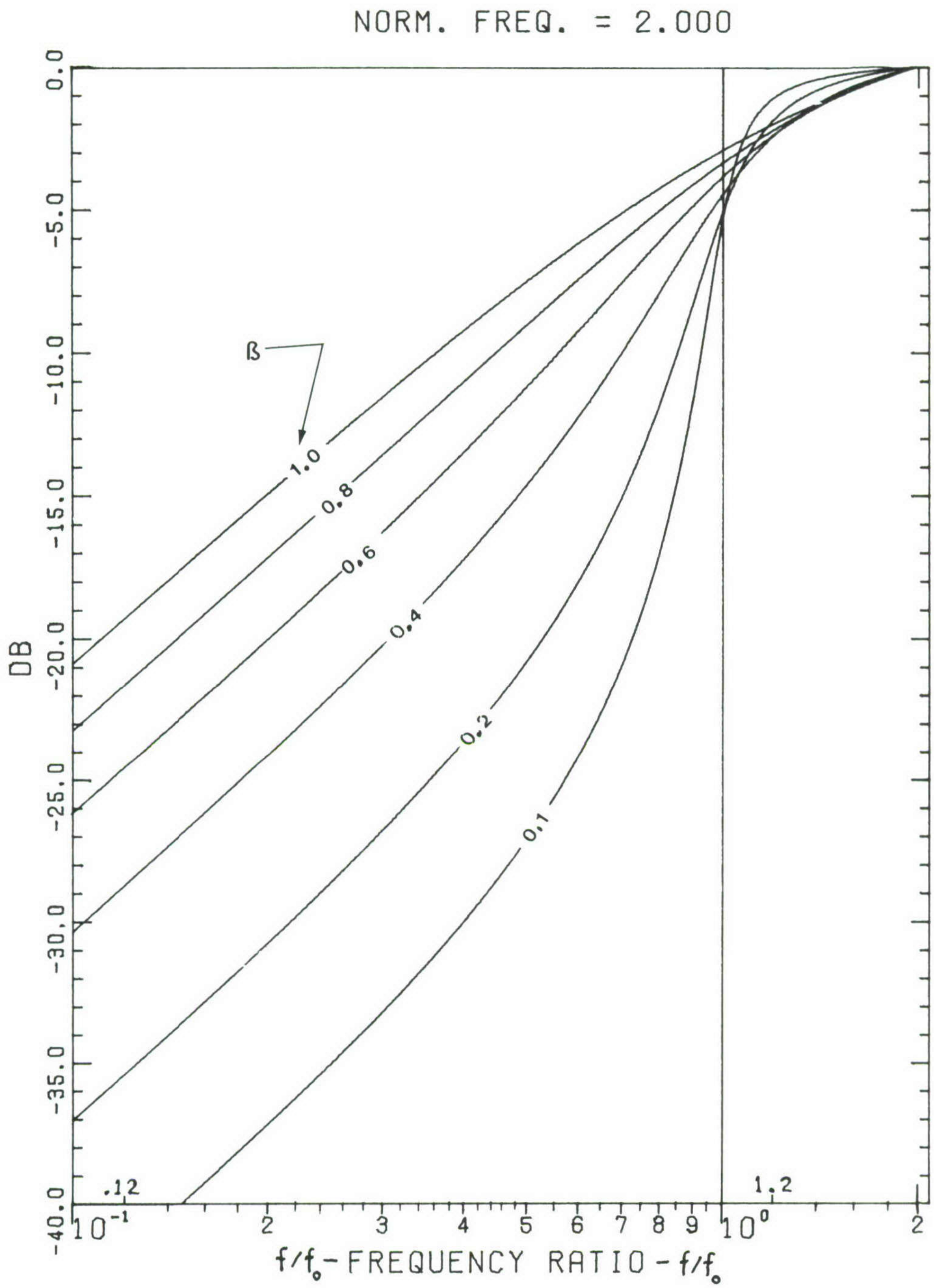


Figure 2. Typical Flex Function for Low Frequency Rolloff

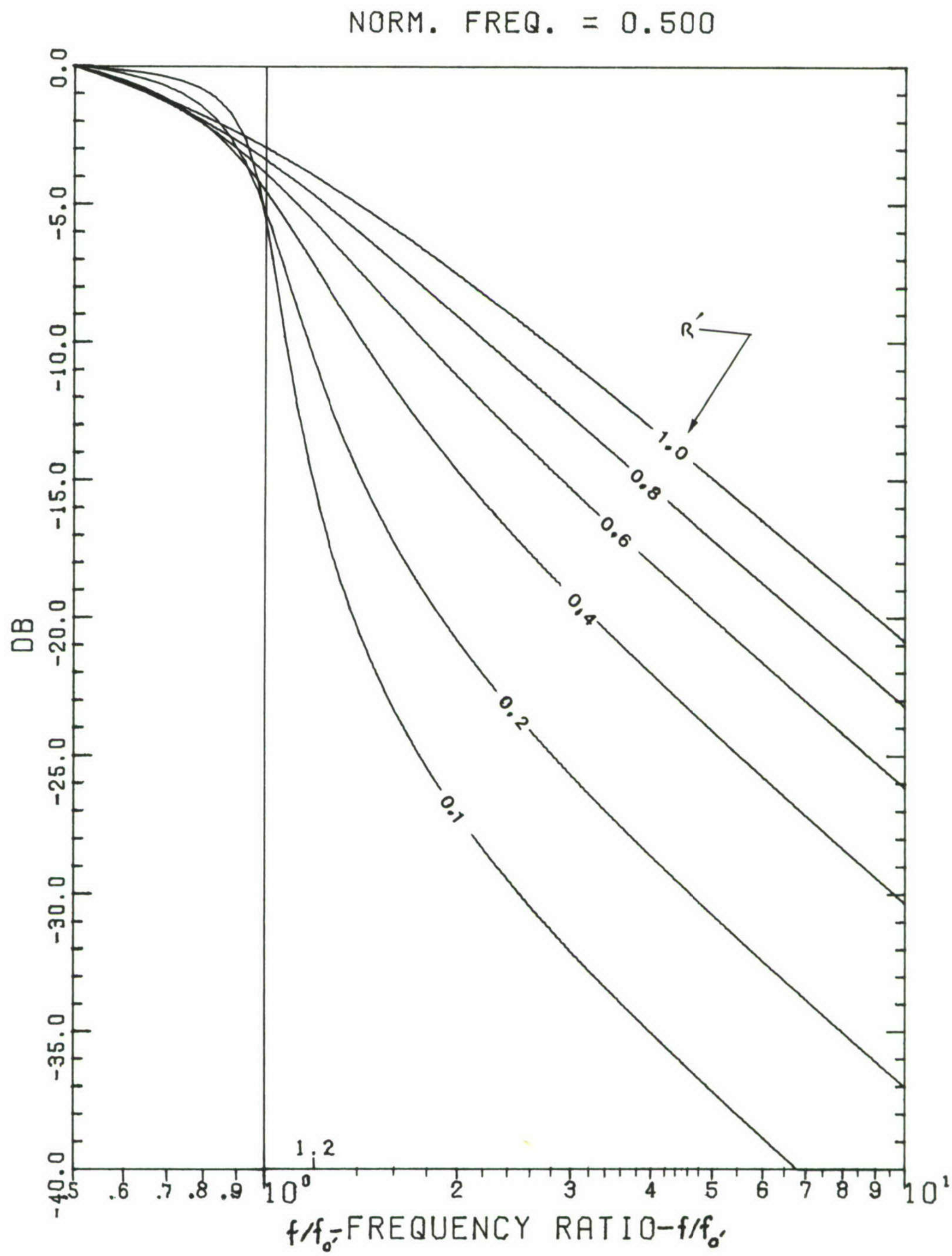


Figure 3. Typical Flex Function for High Frequency Rolloff

2.1 Low Frequency Boost

If we examine the arctan portion of, say, equation (1), we note that the numerator is of the form $2\beta(\omega/\omega_o)^\alpha$, where $\alpha = 1$ for the functions represented by Figures 2 and 3. However, by allowing α to go to zero a novel but useful low frequency pre-emphasis results (Figure 4). In short, the curves (in the low frequencies) are raised; given bass boost, as the audiophiles are fond of saying. Such a phenomena corresponds to what happens to the aircraft vibration spectra as the aircraft passes through certain stages of its flight profile -- for example, during taxi, takeoff roll, the dumping of speed brakes, or flaps; and during gunfire or inflight refueling phases. Note that we may make α a function of time and, operating within the limits of $\alpha = 1$ and $\alpha = 0$, we are able, in a gradual, continuous, and reversible way, to effect the smooth transition from one state to the other. This property is of significance when we view the function as a programmable system capable of describing a useful variety of flight vibration phases.

Notice that identical variations can be reflected into the high frequency rolloff curve (equation 13) by assigning an α' within the interval of 1 and 2. Figure 5 shows a set of functions for $\alpha' = 2.00$. From here on out, alpha will follow the same diacritic symbolism as has been assigned to the other high and low frequency rolloff parameters. Thus, α is assigned to the low frequency rolloff equation and α' refers to the exponent for the high frequency rolloff case. Also, note that unless α and α' are specifically stated, their values are <u>always</u> presumed to be unity.

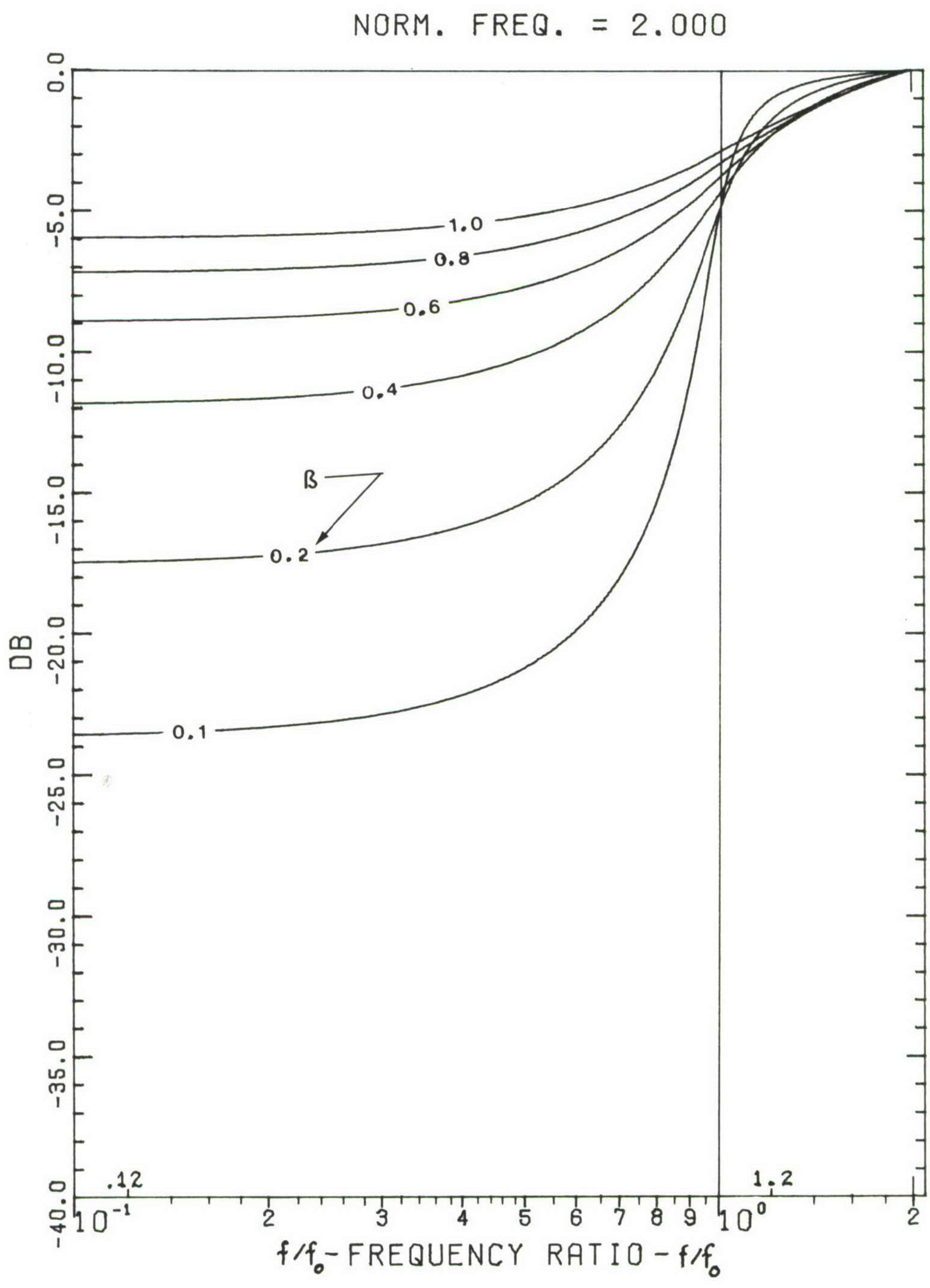


Figure 4. Flex Function with Low Frequency Boost

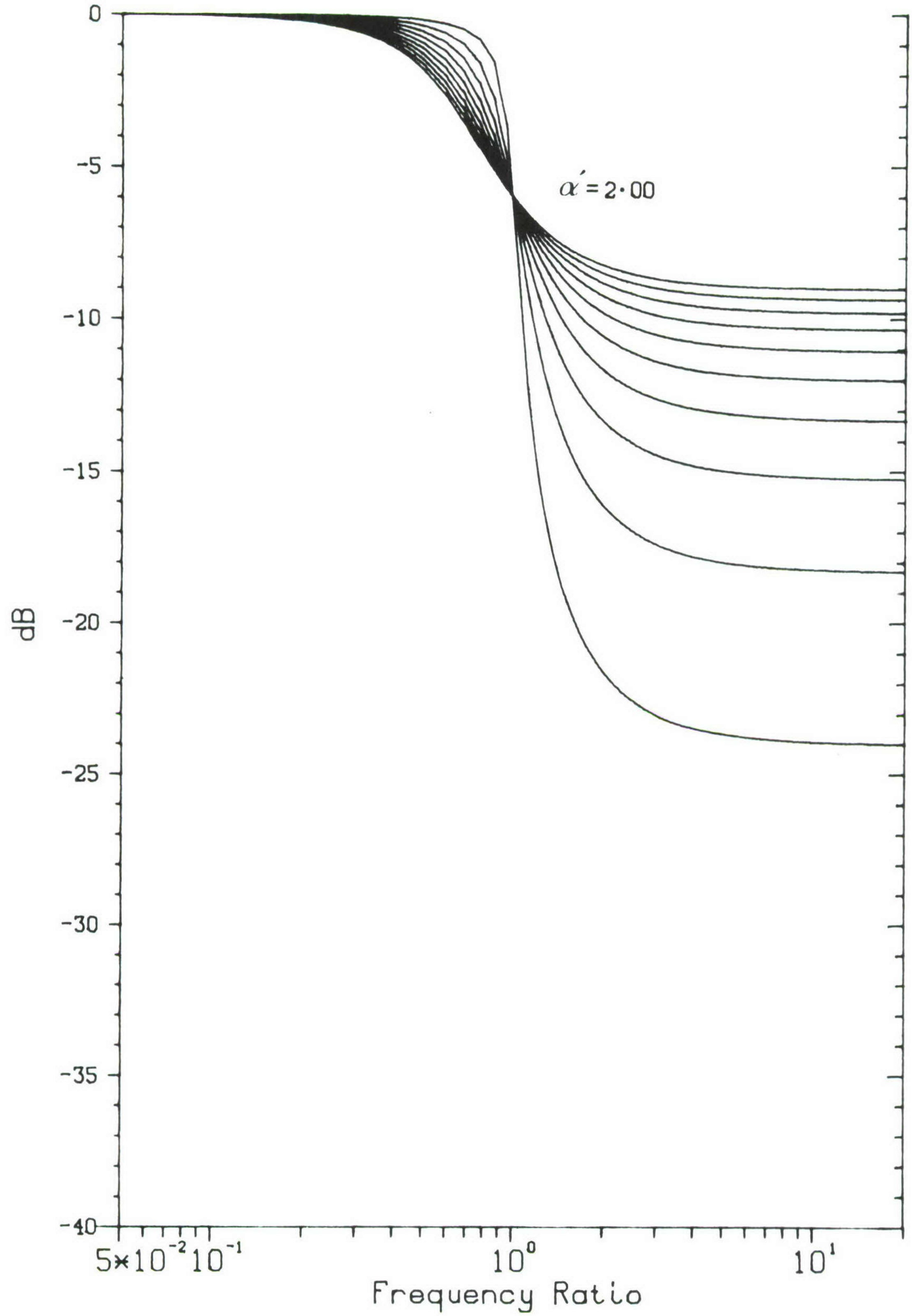


Figure 5. Flex Function with High Frequency Boost

2.2 Boundary Layer Spectra

If we choose $x' = .01$ for the high frequency rolloff function we will obtain a form characterized by a relatively expansive, flat spectrum in the lower frequency part of the curve. Moreover, if we select somewhat different values of β' (0.2, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5) we will have defined a family of curves that will serve to provide a good fit for the pressure spectral density of the boundary layer for a large number of aircraft flight conditions. The boundary layer curves are shown as Figure 6.

3.0 Prediction Equations

The flex function is broken out into the forms and relationships to be used in the computer program. First, the equations are stated in order of progression.

$$P(f)\ [\phi_n(x)L(f),\ M(f),\ H(f)] = G(f) \tag{14}$$

where:

$P(f)$ = the boundary layer pressure spectral density at some downstream distance (x) on the aircraft surface.

$\phi_n(x)L(f)$ = the product of the bending mode shape, $\phi_n(x)$, at downstream distance, x, and the low frequency transfer function, $L(f)$, of the aircraft fuselage.

$M(f)$ = the medium frequency transfer function of the aircraft fuselage internal structure.

$H(f)$ = the high frequency transfer function of the fuselage skin.

$G(f)$ = the PSD response of the aircraft primary structure (g^2/Hz).

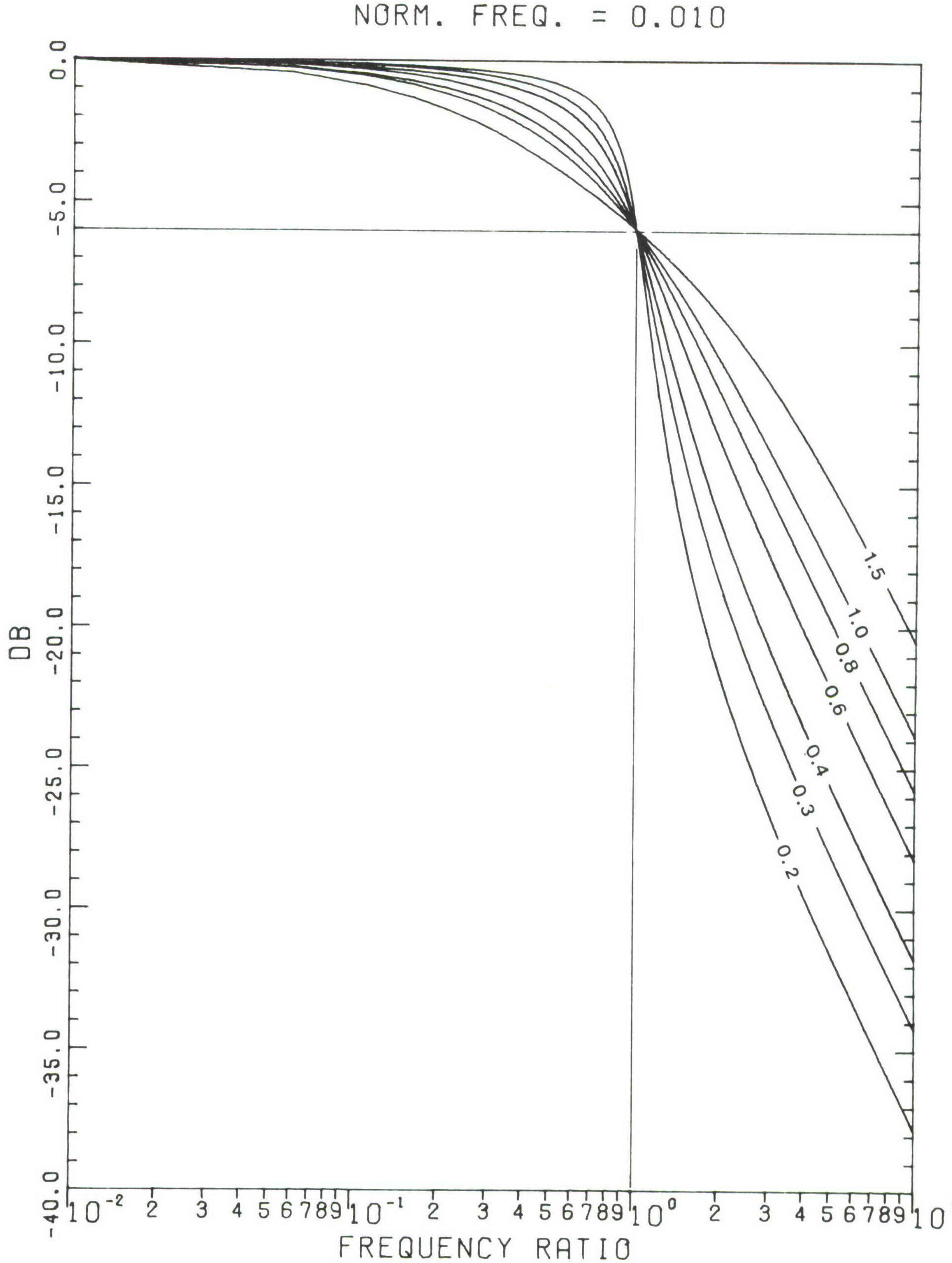


Figure 6. Flex Function Applied to the Aircraft Boundary Layer

The term, primary structure, is defined as that structure of the aircraft which comprises the main load carrying members or elements of the aircraft. Examples of primary structure are skin, frames, rings, bulkheads (periphery), stringers and includes those consoles structurally integrated with the aircraft outer walls.

The working forms for P(f) are described in Appendix A and are listed as equations A-1, A-2, A-3, and A-4.

The mode shape, $\phi_n(x)$, is a function of aircraft type and is included in Appendix B for typical aircraft. The aircraft structural transfer functions L(f), M(f), and H(f) are listed in Appendix C together with appropriate tables.

3.1 Special Functions

Certain flight phases, that deviate from the straight and level condition, are introduced by operating on P(f) with special functions designated, S(f).

$$P(f)S_{BT}(f) = P_{BT}(f) \tag{15}$$

$$P(f)S_{TB}(f) = P_{TB}(f) \tag{16}$$

$$P(f)S_{T}(f) = P_{T}(f) \tag{17}$$

$$P(f)S_{L}(f) = P_{L}(f) \tag{18}$$

where:

$S_{BT}(f)$ = Special function for the buffet turn flight phase.
$P_{BT}(f)$ = Pressure spectral density spectrum of a fighter aircraft during buffet turn (PSF^2/Hz).

$S_T(f)$ = Special function for the takeoff phase.
$P_T(f)$ = Equivalent pressure spectral density spectrum of an aircraft during the takeoff phase (PSF^2/Hz).
$S_L(f)$ = Special function of an aircraft during the landing phase.
$P_L(f)$ = Equivalent pressure spectral density spectrum of an aircraft during the landing phase (PSF^2/Hz).
$S_{TB}(f)$ = Special function for low frequency atmospheric turbulence.

These special functions together with their appropriate tables, curves, and explanations are found in Appendix D.

The second set of basic equations is as follows:

$$G(f)\ Y(f) = R(f) \tag{19}$$

where:

$Y(f)$ = the transfer function for equipments mounted on secondary structure.
$R(f)$ = the PSD response of the secondary structure, or the input to the aircraft equipment, mounted thereon (g^2/Hz).

Secondary structure is defined as that structure to which equipment is attached onto or contained in and whose mounting points terminate at the outer frame, skin, stringers, bulkheads, floors, spars or cast framing of the primary structure. Examples of secondary structure are instrument panels, trays, racks, brackets, shelves, trusses, beams, and consoles.

The final equations apply to those equipment mounting configurations in which isolated equipment are mounted on secondary structure:

$$R(f)\ Y_{I(a)}(f) = a(f) \tag{20}$$

where:

$a(f)$ = The response of the isolated equipments (g^2/Hz).

$Y_{I(a)}(f)$ = Transfer function for equipment mounted on isolators.

$R(f)$ = Response of secondary structure (instrument panels, shelves, or racks) (g^2/Hz).

3.2 Equipment Mounting Categories

How and when $G(f)$, $Y(f)$, and $a(f)$ are used depends upon what, how, and where the equipment is mounted in the aircraft -- and this is established by reference to equipment mounting categories and their associated transfer functions which are classified as follows:

Category I - Equipment(s) attached to primary structure

a. Isolated. Equipment(s) attached to primary structure through vibration isolators.

b. Non-Isolated. Equipment(s) directly attached to primary structure.

Category II - Equipment attached to instrument panels

a. Isolated. Equipment(s) whose instrument panel is attached to primary structure through vibration isolators.

b. Non-Isolated. Equipment(s) whose instrument panel is directly attached to primary structure.

Category III - Equipment(s) mounted on shelves or in racks

a. Isolated. Equipment(s) attached to shelves or in racks - with shelf or rack isolated.

b. Non-Isolated. Equipment(s) attached to shelves or racks - with shelf or rack non-isolated.

Category IV - Equipment(s) that is isolated and mounted on shelves or in racks.

a. Category III(a) with equipment(s) isolated.

b. Category III(b) with equipment(s) isolated.

Category V - Lightweight equipment items directly attached to primary structure via light bracketry.

Category VI - Equipment(s) mounted to or on the bulkhead of the forward looking radar (FLR).

The categories of transfer functions, their tables, curves, and applications are found in Appendix E.

SECTION III

PROGRAMMING

The equations shown in Paragraph 3 of Section II for predicting power spectral density inputs to aircraft equipment are laborious to evaluate - given many selected frequencies over a relatively wide band. And, even though these equations are few in number and are not of themselves complex, a digital computer program was, nonetheless, strongly suggested. Such a program, therefore, was prepared to evaluate the prediction equations at a frequency resolution sufficiently fine to produce quality plots and in the combinations and sequences required by the particular set of input data which describes the aircraft flight profile.

Conceptually, the program is so designed that a minimum of information on flight conditions is required as input for predicting the vibration profiles of the aircraft structure and equipments. The input data consists, chiefly, of numerical values and descriptive information concerning such flight parameters as aircraft type, altitude, Mach number, equipment weight, mounting categories, and flight maneuvers.

For output, the values of the particular transfer and response functions, which were a part of the prediction process, are printed in tabular form and presented as a function of frequency. If desired, plots of these results can be produced on peripheral plotters.

1.0 Program

The program consists of a relatively large main section which, in its operation, "calls" approximately a dozen subroutines. The structure is simple.

2.0 Program Preparation

The program is prepared for execution by first punching numerical and alpha-numeric descriptive information for key aircraft and flight profile parameters on cards, in specified field locations; then inserting these cards in the program deck at its end.

2.1 Execution

On program execution, tabulations of the input, the transfer and the response functions are printed (dB as a function of frequency). The information necessary for producing plots of these tabulated values is transferred in a device-independent, standard form from central memory to a permanent file located in mass storage.

In the final step, plots of all or selected transfer functions are obtained by executing a small post-processor program containing a plot-directive card which is inserted by the user. This program provides for transfer of the plot information from the permanent file to central memory and also provides a "write", on magnetic tape, of information necessary for a plot of each of the functions specified on the plot-directive card. This tape is mounted on a CALCOMP plotter to produce the plots.

Before we proceed to the program deck card order -- the plot, the keyboard instructions, and, finally, the card preparation -- it is useful to note that the basic language and format of the program (Appendix F) is Fortran IV and as such may be readily adapted to other computer facilities. However, certain address characteristics of the card arrays, the plotting, the display instructions reflect the needs of the individual computer facility; and the demands of its terminals. In this report, the ASD Computer Facility and Terminals are invoked -- elsewhere, the reader is invited to consult local computer services.

2.2 Functions* Available for Plotting

	Categories Ia, IIa, IIb, IIIa, IIIb, V, VI
Straight and Level	$P(f)$, $G(f)$, $Y(f)$, $R(f)$
Buffet-Turn	$P_{BT}(f)$, $G_{BT}(f)$, $Y(f)$, $R_{BT}(f)$
Takeoff	$P_T(f)$, $G_T(f)$, $Y(f)$, $R_T(f)$
Landing	$P_L(f)$, $G_L(f)$, $Y(f)$, $R_L(f)$
Turbulence	$P_{TB}(f)$, $G_{TB}(f)$, $Y(f)$, $R_{TB}(f)$

	Categories IVa and IVb
Straight and Level	$P(f)$, $G(f)$, $Y(f)$, $R(f)$, $Y_{1A}(f)$, $A(f)$
Buffet-Turn	$P_{BT}(f)$, $G_{BT}(f)$, $Y(f)$, $R_{BT}(f)$, $Y_{1A}(f)$, $A_{BT}(f)$
Takeoff	$P_T(f)$, $G_T(f)$, $Y(f)$, $R_T(f)$, $Y_{1A}(f)$, $A_T(f)$
Landing	$P_L(f)$, $G_L(f)$, $Y(f)$, $R_L(f)$, $Y_{1A}(f)$, $A_L(f)$
Turbulence	$P_{TB}(f)$, $G_{TB}(f)$, $Y(f)$, $R_{TB}(f)$, $Y_{1A}(f)$, $A_{TB}(f)$

* See Appendices D and E

Category Ib

Straight and Level	$P(f)$, $G(f)$
Buffet-Turn	$P_{BT}(f)$, $G_{BT}(f)$
Takeoff	$P_T(f)$, $G_T(f)$
Landing	$P_L(f)$, $G_L(f)$
Turbulence	$P_{TB}(f)$, $G_{TB}(f)$

Execution is essentially sequential -- the only important branch is a loop from the program end back to the beginning in order to repeat the process whenever the aircraft flight parameters change. All other branches terminate at nearby statements.

Transfer and response functions can be plotted on a CALCOMP (incremental) plotter. Calls are made to selected subroutines in the DISSPLA* software system for the desired data display.

Salient features of program design are summarized below.

Language:	FORTRAN IV
Digital Computer:	Control Data Corp., 6600 and Cyber 73 computers
Central Memory Requirements:	120,000 (octal) words for compiler; program, and plot subroutines
Word Size:	10 characters
Variable Name Size:	6 characters, maximum
Input Data:	Punched on 80-column cards

* The acronym for "Display Integrated Software System, and Plotting Language," developed and sold by the Integrated Software Systems Corp., San Diego, CA.

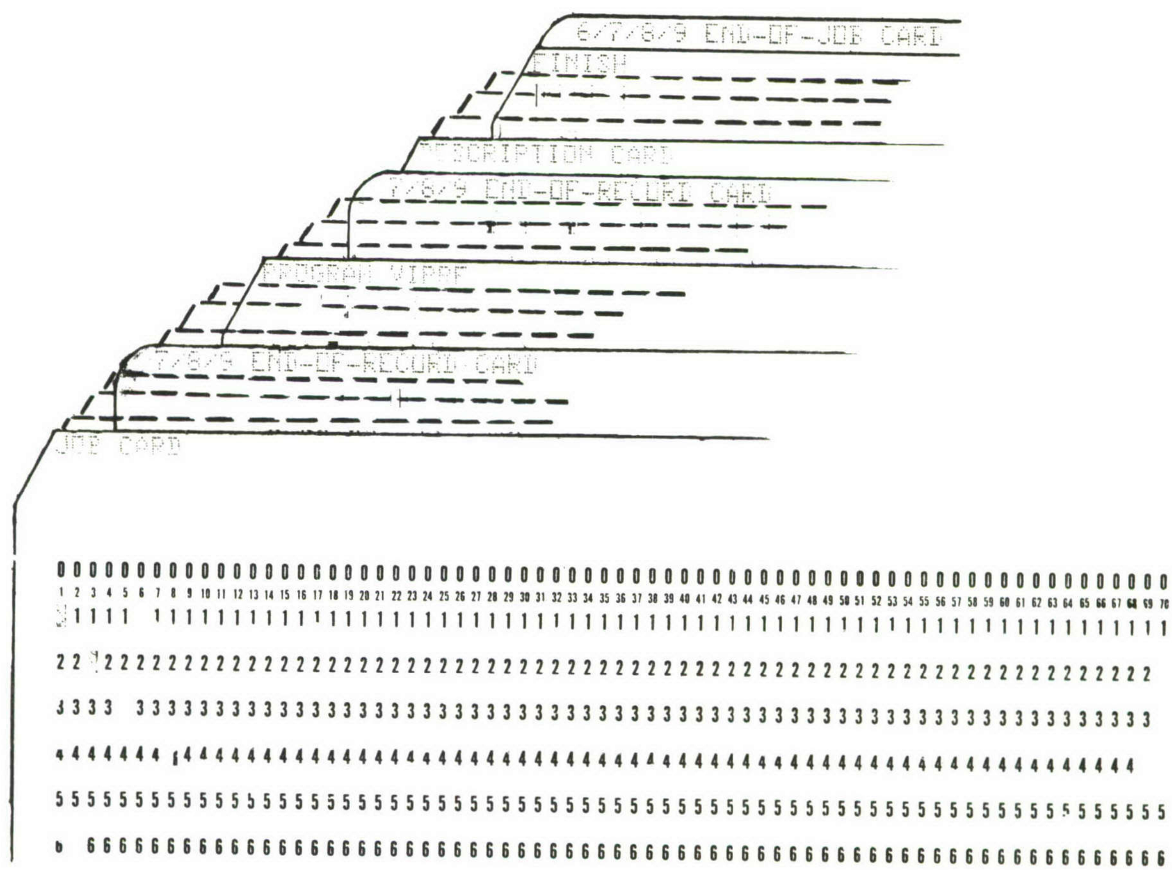
Output:	135-column printed tabulations and off-line plots
Library Mathematical Functions:	Common logarithm and arc-tangent (double argument)

3.0 Program Deck Setup and Card Preparation

3.1 Job Deck Setup

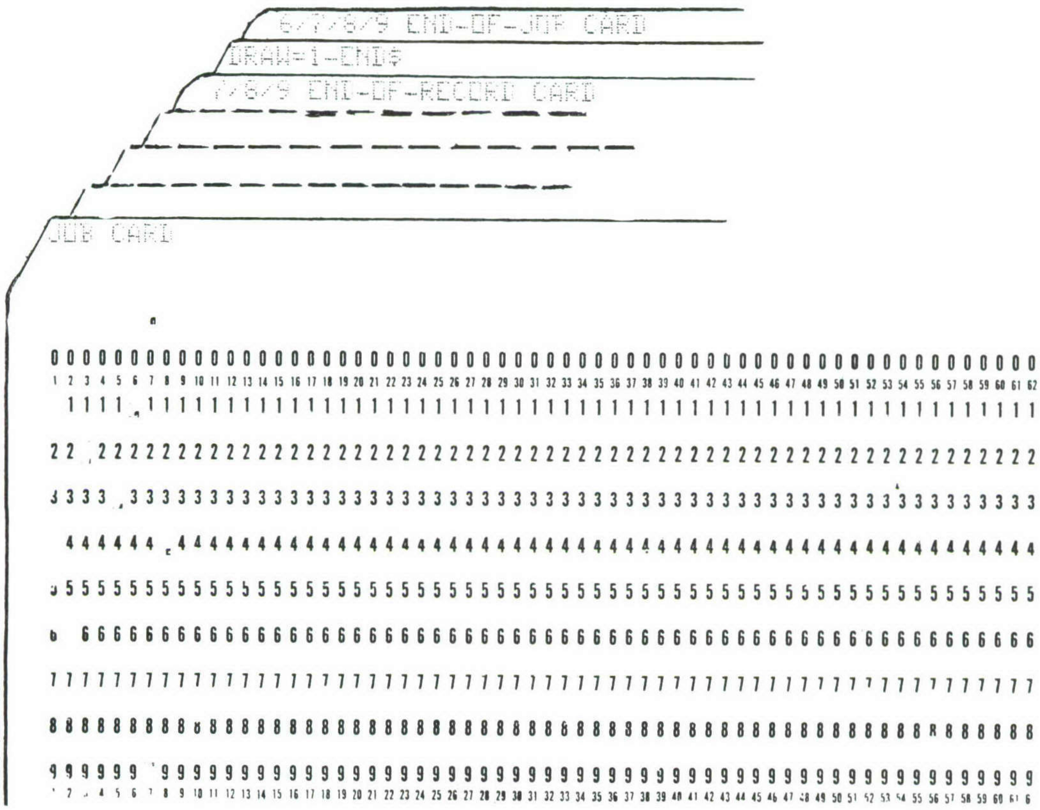
The first step in the procedure to obtain plots of the predicted vibration spectra requires the execution of the program, VIPRF. Upon execution, a printed output is produced; likewise, the plot information is transferred to a permanent file.

The following illustration shows the structure of the card deck setup for program execution.



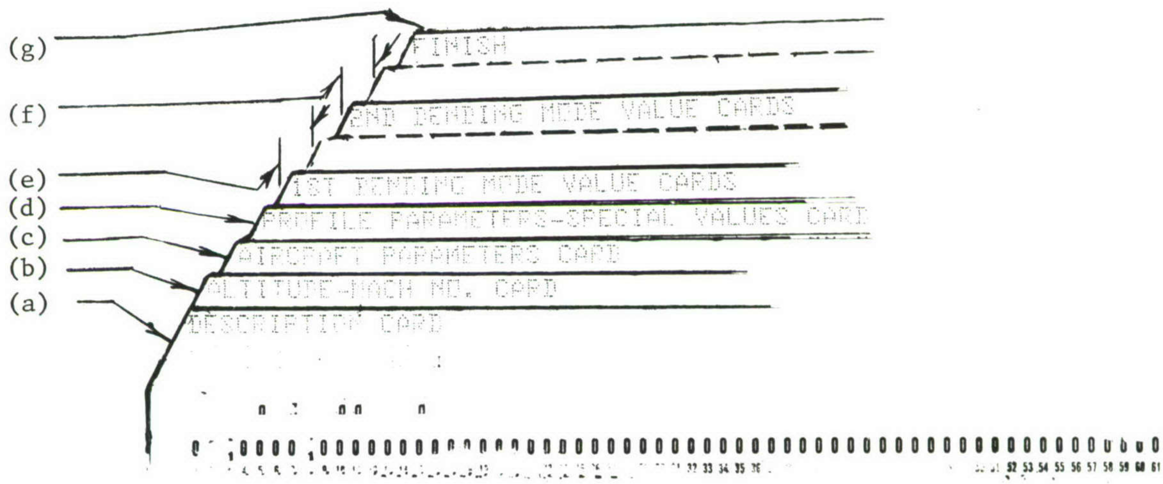
The second and final step in the procedure involves execution of either the ONLINE or the OFFLINE, DISSPLA, post-processor plot program. In this phase, plot information is obtained from the permanent file (previously generated); then, plots are produced either on-line or off-line, in this case, utilizing a CALCOMP plotter.

The structure of the deck setup is shown in the following illustration.



3.1.1 Input Data Deck Setup

Program input data is entered on the cards shown in the next illustration. Note that the cards must be inserted in the deck in the indicated order.



The Description, the Altitude-Mach Number, and the Aircraft Parameter cards must always be prepared and inserted in the deck.

The Profile Parameters and Special Values cards must always be inserted. If the values are already stored in the program (as is, currently, the case for the F-4, F-15, F-16, F-111, and the A-7), then a blank card must be inserted. Any profile parameter or special value can be changed, however, by entering the desired value on the normally blank card. This feature permits the user to "write over" the stored values as the situation requires. If an aircraft different from the stored group is chosen, then a Profile Parameters and Special Values card must be inserted with appropriate entries. Note that in either case, a card must be inserted, blank or not.

The procedural mechanics are more complex when dealing with the first and second bending mode value cards. Here, the combination of orders of proper card usage are such that special guidance must be provided in the form of a summary aid and a table, both of which now follow.

3.1.1.1 Summary of Input Data Card Structure

We return to the last illustration to summarize the rules of order and procedure concerning the card structure of the input data. The summary also makes reference to special guidance in the form of Table I.

Cards	Remarks
a,b,c	These cards must always be prepared and inserted in the deck.
d	A blank card is normally inserted in the deck if aircraft is of the previously stored group (see 3.1.1). Stored values may be written-over by inserting desired values on the blank card. For aircraft not of the stored group, enter appropriate values on the blank card (see Table I).
e,f	Both card sets are normally omitted if the aircraft is of the previously stored group; however, if data changes are required, see Table I.
g	The FINISH card must always be inserted at the end of a set of data cards.

TABLE I

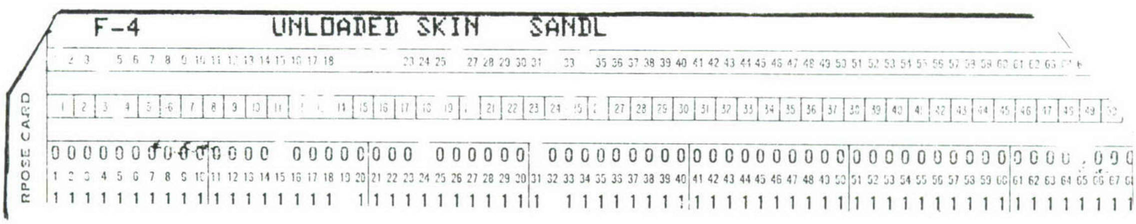
Card Usage Guidance -- Bending Mode Data

1st Mode		2nd Mode				
Stored Data Cards	Read From Input Data Cards	Stored Data Cards	Read From External Input Data Cards	Unavailable	Insert Cards:	Special Entries In Card (d)
X		X			(a) thru (d) followed by (g)	
X				X	(a) thru (d) followed by (g)	enter $f_{2n}=0$
X			X		(a) thru (d) followed by a blank card, followed by a set of 2nd bending mode cards (f); followed by (g)	
	X	X			(a) thru (d) followed by a set of 1st bending mode cards (e); followed by (g)	
	X			X	(a) thru (d) followed by a set of 1st bending mode cards (e); followed by (g)	enter $f_{2n}=0$

3.1.2 Card Preparation for Input Data

Each card example is shown in proper sequence, selected and punched with the input data for the program. Included are column identifications, associated nomenclature, and explanatory references.

3.1.2.1 DESCRIPTION Card



__Aircraft Type__

COL. 10 Aircraft Type (center aircraft designation in 10-column field to obtain centering plot titles)

Note that the following aircraft types occupy a specific columnar order because certain of their values (Profile Parameters and Special Values; First and Second Bending Mode values) have been previously stored in the program.

COL. 4-6	F-4	Enter on card exactly as specified here.
4-7	F-15	
4-7	F-16	
4-8	F-111	
4-7	A-7D	

This order requirement also holds for any future aircraft, so stored. For example, the A-10 would occupy columns 4 through 7.

__Equipment Description__

COL. 11-30 Name of equipment item or location (center name in 20-column field to obtain centering in plot titles)

__Flight Condition__

COL. 31-35 SANDL, straight and level

COL. 31-32 BT, buffet-turn* (see Appendix D)

COL. 31-37 TAKEOFF, takeoff (see Appendix D)

COL. 31-37 LANDING, landing (see Appendix D)

COL. 31-32 TB, turbulence* (see Appendix D)

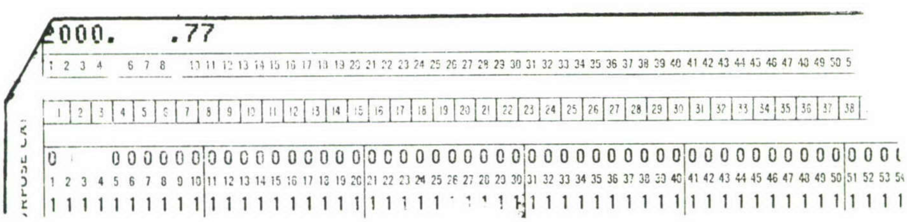
*Requires a straight and level reference flight condition that must be entered in the Altitude-Mach Number card (see 3.1.2.2).

Plot Selection

COL. 41-50 Leave all columns blank if only the plot of the final response function is desired [G(f), R(f), or A(f)].

COL. 41-43 Enter ALL, if plots of all of the special, transfer, and response functions are desired.

3.1.2.2 Altitude-Mach Number Card



COL. 1-8 Altitude, H, feet, of 1st altitude-mach number combination.

COL. 9-13 Mach no., M, of 1st altitude-mach number combination.

COL. 14-21 Altitude, H, feet, of 2nd altitude-mach number combination.

COL. 22-26 Mach no., M, of 2nd altitude-mach number combination.

COL. 27-34 Altitude, H, feet, of 3rd altitude-mach number combination.

COL. 35-39 Mach No., M, of 3rd altitude-mach number combination.

COL. 40-47 Altitude, H, feet, of 4th altitude-mach number combination.

COL. 48-52 Mach no., M, of 4th altitude-mach number combination.

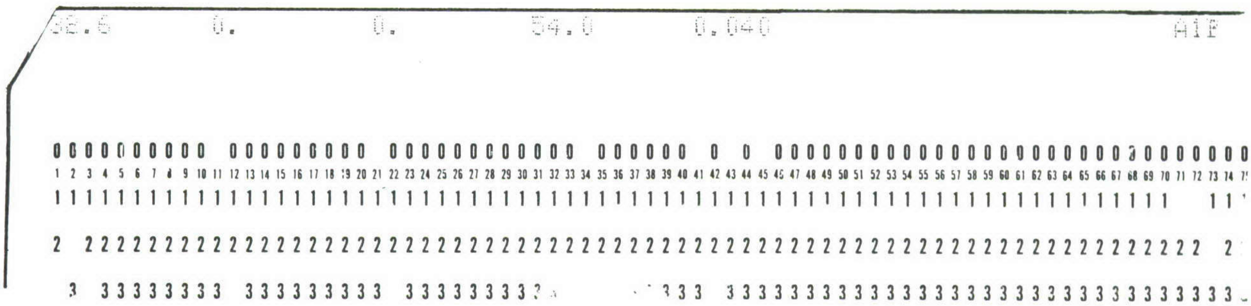
COL. 53-60 Altitude, H, feet, of 5th altitude-mach number combination.

COL. 61-65 Mach no., M, of 5th altitude-mach number combination.

COL. 66-73 Altitude, H, feet of 6th altitude-mach number combination.

COL. 74-78 Mach no., M, of 6th altitude-mach number combination.

3.1.2.3 AIRCRAFT PARAMETERS Card



COL. 1-10 Aerodynamic distance, x_E (feet) (see Appendix B).

COL. 11-20 Distance of equipment from skin, R_s (inches).

COL. 21-30 Equipment weight, W_E (pounds).

COL. 31-40 Nominal fuselage diameter, D_F; at x_E (inches).

COL. 41-50 Aircraft skin thickness, t (inches).

<u>Center Frequency, f_c, of Transfer Function, Y(f)</u>

<u>If Category is not IVa, IVb, or Ib*</u>

COL. 51-60 Center frequency of specified category, f_c, (Hz) (leave blank if unknown).

COL. 61-70 Blank.

*For selection guidance, see Table II. Also, note that Category I(b) has a transfer function (previously built into the program) that is automatically invoked when I(b) is selected (see Figure E-1(b)).

If Category is IVa or IVb*

COL. 51-60 Center frequency for Category Ia, f_{cIA}(Hz) (leave blank if unknown).

COL. 61-70 Center frequency, f_c(Hz) for Category IIIa, if Category IVa is specified; Category IIIb, if Category IVb is specified (leave blank if unknown).

COL. 71 Skin material

A for aluminum
T for titanium
S for steel
M for magnesium

TABLE II

Recommended Center Frequencies of
Y(f) When f_c is Either Unknown or Unspecified

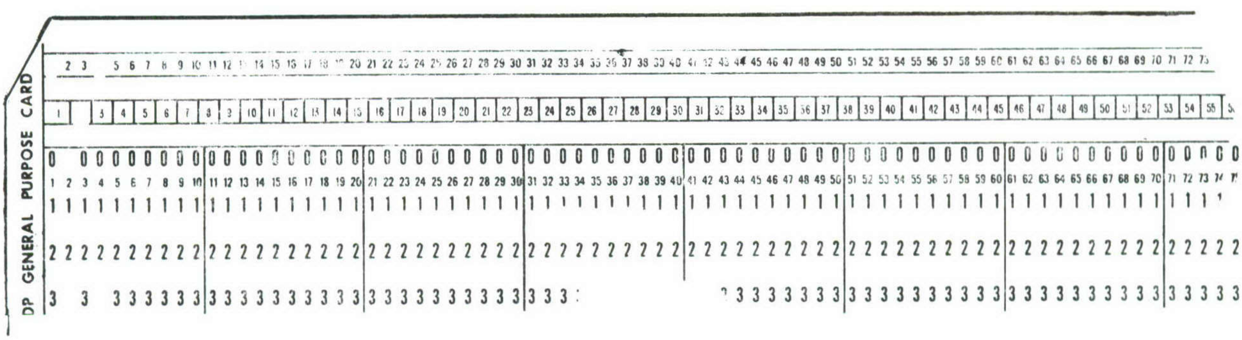
Category	f_c
Ia	25 Hz
IIa	43 Hz
IIb	40 Hz
IIIa	25 Hz
IIIb	35 Hz
V	200 Hz

*For selection guidance, see Table II. Also, note that Category I(b) has a transfer function (previously built into the program) that is automatically invoked when I(b) is selected (see Figure E-1(b)).

Equipment Mounting Category (see Appendix E)

COL. 72-73	1A for Category	Ia
	1B	Ib
	2A	IIa
	2B	IIb
	3A	IIIa
	3B	IIIb
	4A	IVa
	4B	IVb
COL. 72	5	V
	6	VI

3.1.2.4 PROFILE PARAMETERS AND SPECIAL VALUES Card*



COL. 1-10 First fuselage bending mode, vertical, symmetric f_n (Hz) (see Appendix B).

COL. 11-20 Maximum of first bending mode low frequency transfer function, $L_M(f)$ (dB) (see Appendix C).

COL. 21-30 Second fuselage bending mode, vertical, symmetric, f_{2n} (Hz) Enter zero if f_{2n} is unavailable (see Table I).

COL. 31-40 Maximum of second bending mode low frequency transfer function, $L_2(f)_M$ (dB). (see Appendix C)

COL. 41-50 Maximum of special function, $S_{BT}(f)_M$ (dB) (see Appendix D).

COL. 51-60 Distance to aircraft mid-chord at wing, x_{BT} (feet) (see Appendix D).

---

*Card is normally blank unless specific changes are required or unless aircraft type is other than F-4, F-111, F-15, F-16, and A-7; in which case, the appropriate parameters and special values must be entered (see 3.1.1.1).

COL. 61-70 Distance to main landing gear strut, x_T or x_L (feet) (see Appendix D).

COL. 71-80 Multiplication constant, K. Unless otherwise specified, K=1 (leave blank if straight-and-level flight condition (SANDL) is specified).

3.1.2.5 FIRST BENDING MODE VALUES Cards

Card 1

COL. 1-2 No. of ordinal (dB) values, N

COL. 3-8 Interval, Δx, along abscissa

COL. 9-14 Value 1, db

COL. 15-20 Value 2, db

COL. 75-80 Value 12, db

Card 2

COL. 1-6 Value 13, db

COL. 7-12 Value 14, db

COL. 73-78 Value 25, db

Card 3

COL. 1-6 Value 26, db

COL. 7-12 Value 24, db

COL. 73-78 Value 38, db

Card 4

COL. 1-6 Value 39, db

COL. 7-12 Value 40, db

COL. 73-78 Value 51, db

The above values of dB(x), db(x_I), correspond to values of downstream distance x, which are uniformly spaced, Δx apart:

$$dB(x_I) = db\ [(I-1)\Delta x],\ I = 1, 2, \ldots, N$$

If N $\geq$ 52, prepare additional cards, as required, with 12 values per card, following the format of card 2.

3.1.2.6 SECOND BENDING MODE VALUES Cards
(Omit these cards if no entry is made for f_{2n}).

Card 1

COL. 1-2 No. of ordinal (db) values, n

COL. 3-8 Interval, Δx, along abscissa

COL. 9-14 Value 1, dB

COL. 15-20 Value 2, dB

COL. 75-80 Value 12, dB

Card 2

COL. 1-6 Value 13, dB

COL. 7-12 Value 14, dB

COL. 73-78 Value 25, dB

Card 3

COL. 1-6 Value 26, dB

COL. 7-12 Value 27, dB

COL. 73-78 Value 38, dB

Card 4

COL. 1-6 Value 39, dB

COL. 7-12 Value 40, dB

COL. 73-78 Value 51, dB

For n $\geq$ 52 and for an explanation of the origin of the decibel values, refer to the remarks made for the first bending mode values.

3.1.2.7 FINISH Card*

COL. 1-6 FINISH

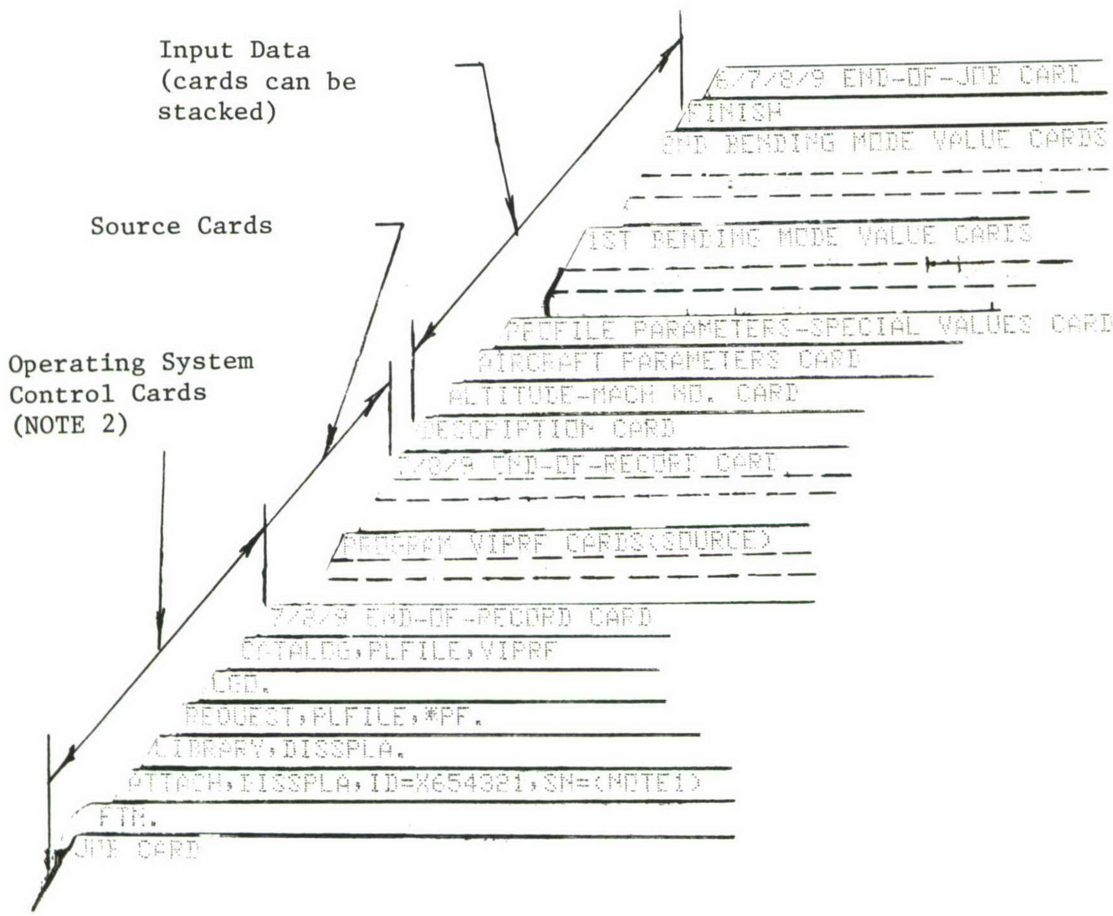
3.1.3 Deck Setup Card Forms ("Source" and "Binary")

In the following illustrations, deck setups are shown for execution of the program in both the source and the binary card form (Control Data Corp. 6600 and Cyber 74 Computer System, using the NOS/BE operating system).

The DISSPLA plot file (PLFILE) is copied to the permanent file, VIPRF.

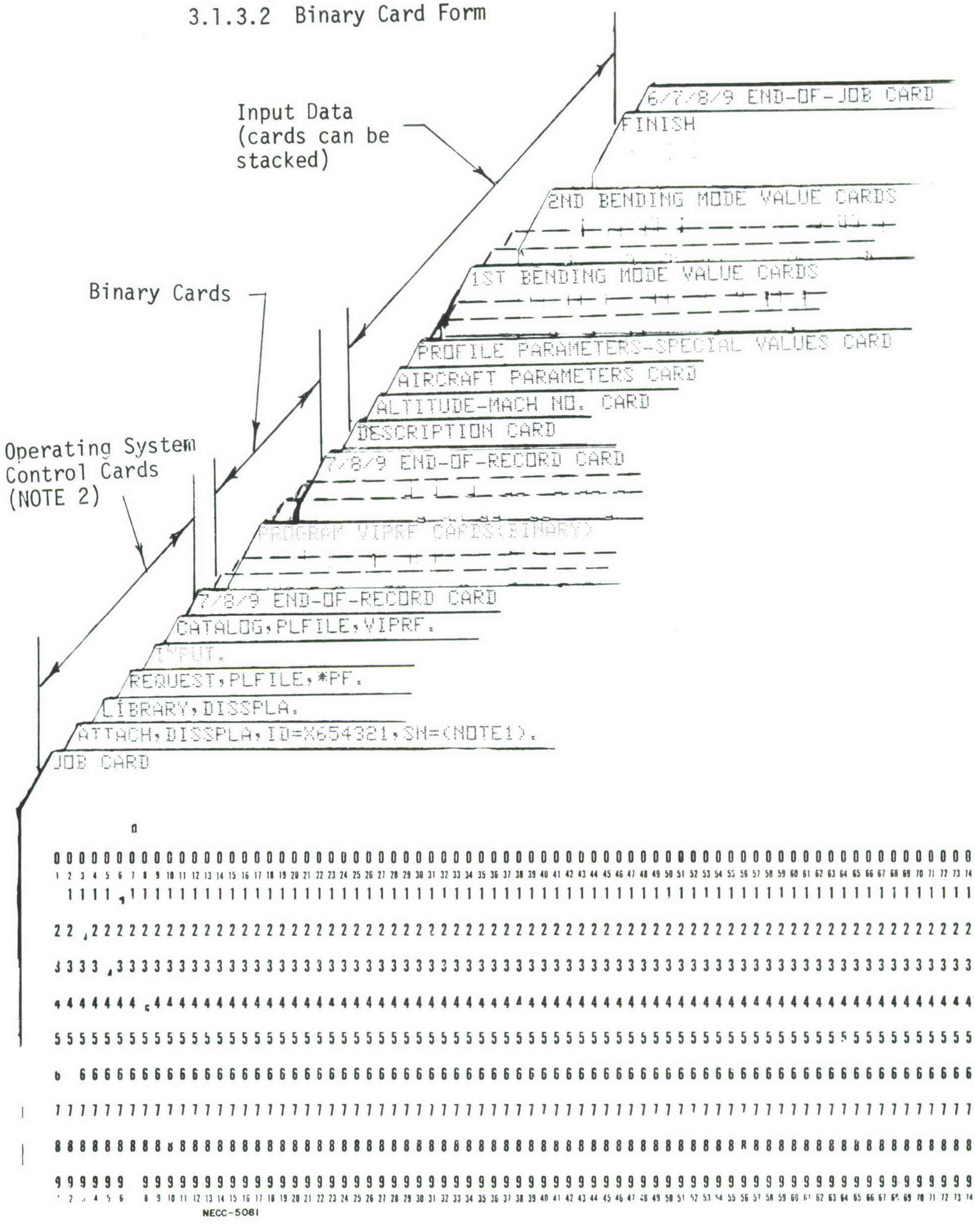
Both illustrations refer to notes that are found at the end of 3.1.4.3.

3.1.3.1 Source Card Form



*Must be last card in every set of input data cards -- cannot be omitted.

3.1.3.2 Binary Card Form



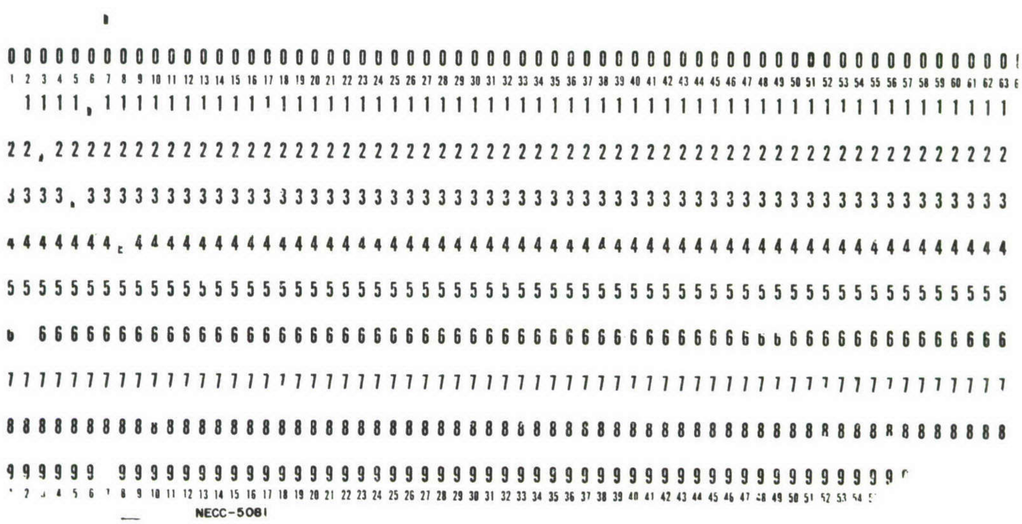
3.1.4 Plot Programs ("On-line" and "Off-line")

In the following illustrations, deck setups are shown for executing the "on-line" and "off-line," DISSPLA, post processor plot programs.

3.1.4.1 "On-line" Plot Program

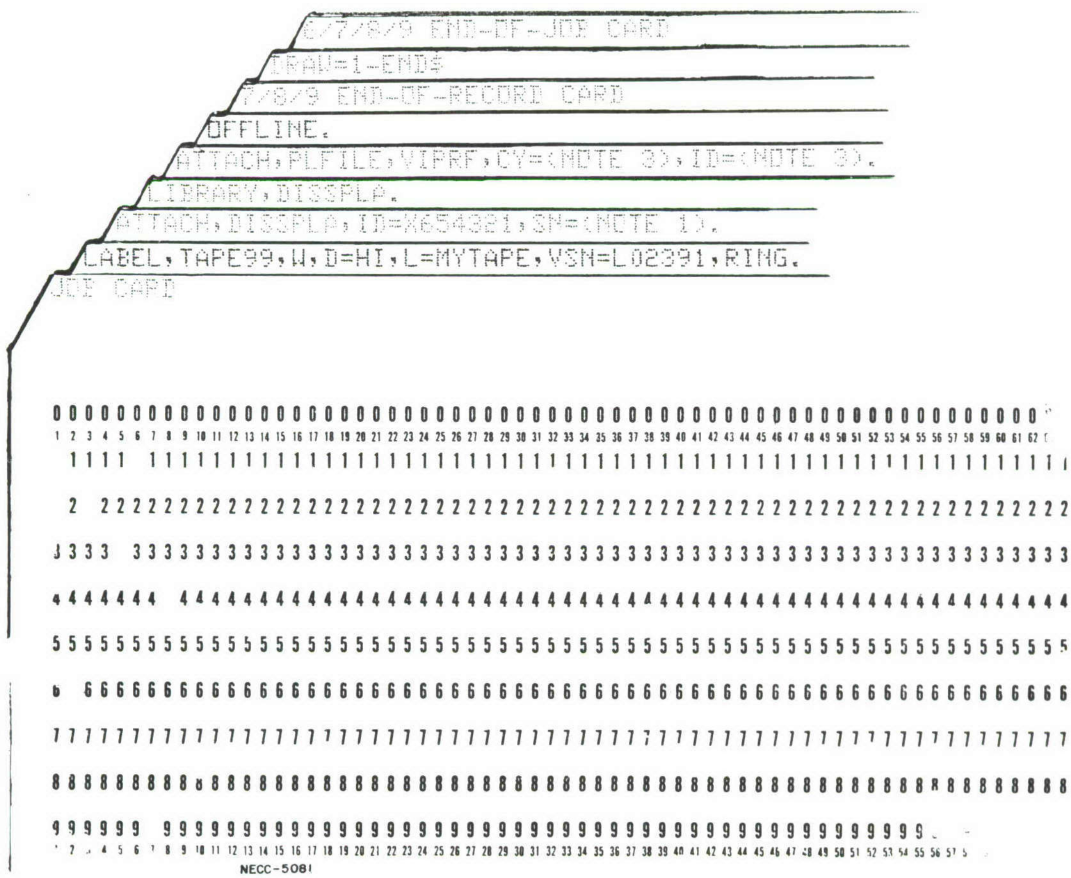
DISSPLA plots are produced on-line, on a CALCOMP plotter.

```
6/7/8/9 END-OF-JOB CARD
DRAW=1-END$
7/8/9 END-OF-RECORD CARD
RETURN,DISSPLA,PLFILE.
ONLINE.
ATTACH,PLFILE,VIPRF,CY=(NOTE 3),ID=(NOTE 3).
LIBRARY,DISSPLA.
ATTACH,DISSPLA,ID=X654321,SN=(NOTE 1).
JOB CARD
```



3.1.4.2 "Off-line" Plot Program

Final plot information is copied to file on magnetic tape (Tape 99). Then, this tape is transferred to an off-line plotter system for graphical recording. However, before any of this can be done, it is necessary to request (Computer Operations) the desired tape to be assigned to Tape 99. In the case illustrated here, the tape number is L02391. Note that if the job deck is submitted at the ASD Computer Center, Operations must be so instructed through submission of card form ASD-59, "Magnetic Tape Transaction Request." On this form the tape number and associated problem number is entered; whereupon the form is submitted together with the job deck. Finally, subsequent to plot program execution, Operations must be directed to mount the tape on the off-line plotter through submission of card form ASD-227, "Data Preparation Request." This card must include the tape and associated problem number as well as identification and plot information obtained from the day file of the computer program listing.



3.1.4.3 Keyboard Visual Display

Keyboard Commands

```
LOG-IN INFORMATION (see ASD Computer Center Inter-
   com Guide)
ATTACH,PLFILE,VIPRF,CY=(NOTE3),ID=(NOTE3)
ATTACH,DISSPLA,ID=X654321,SN=(NOTE1)
XEQ,LIBLOAD=DISSPLA,TEK4010
DRAW=1-END$
LOG-OUT
```

NOTES:

1. SN = ASD for computer system A.
   SN = AFIT for computer system B.
2. Refer to ASD computer center handbook, CDC NOS/BE USER'S GUIDE (latest revision).
3. CY = Permanent file cycle number shown in dayfile of computer listing.
   ID = Problem number under which permanent file was catalogued (shown in dayfile of computer listing).

SECTION IV

APPLICATIONS

1.0 Examples

To illustrate the applications of the prediction program, a number of fighter aircraft are selected for a variety of equipment locations, categories, and flight conditions.

1.1 F-4 (skin)

The inputs (card entries) are:

	SKIN RESPONSE	SANDL
H =	2000.0	ALTITUDE (FT.)
M =	.77	MACH NO.
X_E =	32.60	DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMIC PROFILE (FT.)
R_S =	0.00	DISTANCE FROM SKIN (IN.)
W_E =	0.00	EQUIPMENT WEIGHT (LBS.)
T =	.0400	THICKNESS OF SKIN MATERIAL (IN.)
D_F =	54.0	DIAMETER OF FUSELAGE (IN.)
MATERIAL =	ALUMINUM	TYPE SKIN MATERIAL
CATEGORY =	1B	EQUIPMENT MOUNTING CATEGORY

The input, as it is entered on the input data cards, is shown in Figure 7. (Each of the five examples in this section are accompanied by their respective array of input data cards.) Note that five cards per array are shown -- in agreement with the guidelines provided by Table I and 3.1.1.

As an illustration, this example is rather special. It is interesting because the results describes the response of the unloaded

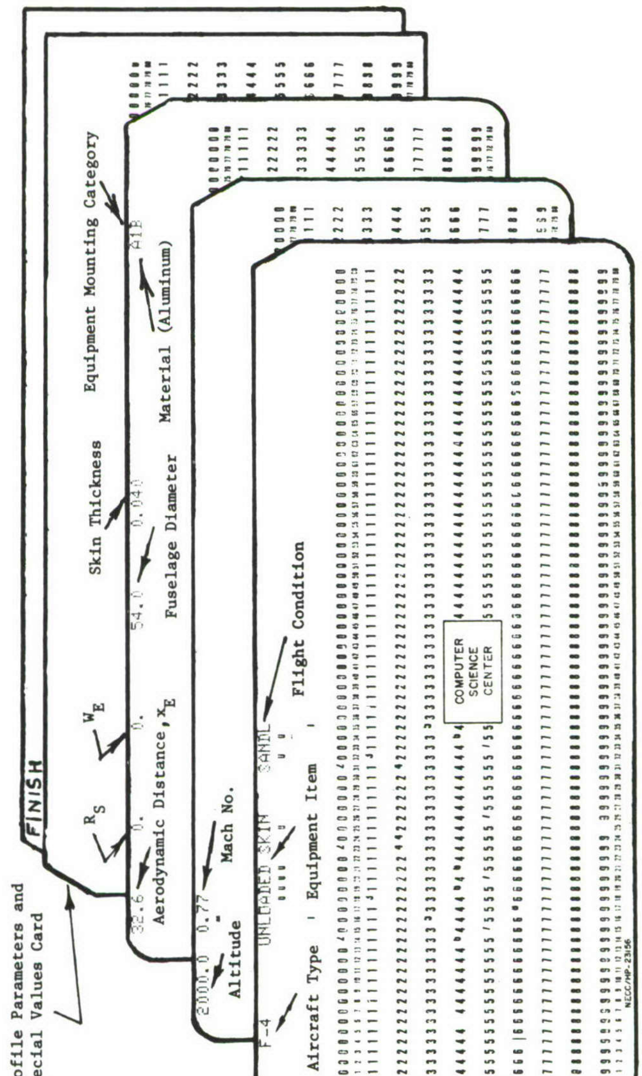


Figure 7. Input Data Cards, RF-4C Skin

skin (R_S and W_E = 0) for straight and level (SANDL) flight. See Figures 8 and 9. The low frequency hump in Figure 9 represents the vibration contributions of the first and second fuselage bending modes.

1.2 F-16 (FCC)

Here, the prediction program describes the vibration input to the Flight Control Computer (FCC) of the F-16 (Figures 11 and 12) during straight and level flight. This example introduces the equipment configuration in which R_S and W_E are greater than zero -- as will be the case from here on out.

F-16	FCC	SANDL
H =	13000.0	ALTITUDE (FT.)
M =	1.55	MACH NO.
X_E =	7.50	DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMIC PROFILE (FT.)
R_S =	3.00	DISTANCE FROM SKIN (IN.)
W_E =	31.20	EQUIPMENT WEIGHT (LBS.)
T =	.0360	THICKNESS OF SKIN MATERIAL (IN.)
D_F =	40.0	DIAMETER OF FUSELAGE (IN.)
MATERIAL =	ALUMINUM	TYPE SKIN MATERIAL
CATEGORY =	1B	EQUIPMENT MOUNTING CATEGORY

1.3 F-4 (Instr. Panel, non-isolated)

This prediction problem describes the vibration spectrum of the radar altimeter indicator (RAI) located on the left side of the instrument panel, aft cockpit (Figures 14 and 15). The instrument panel is hard mounted (non-isolated). Flight conditions are straight and level (SANDL).

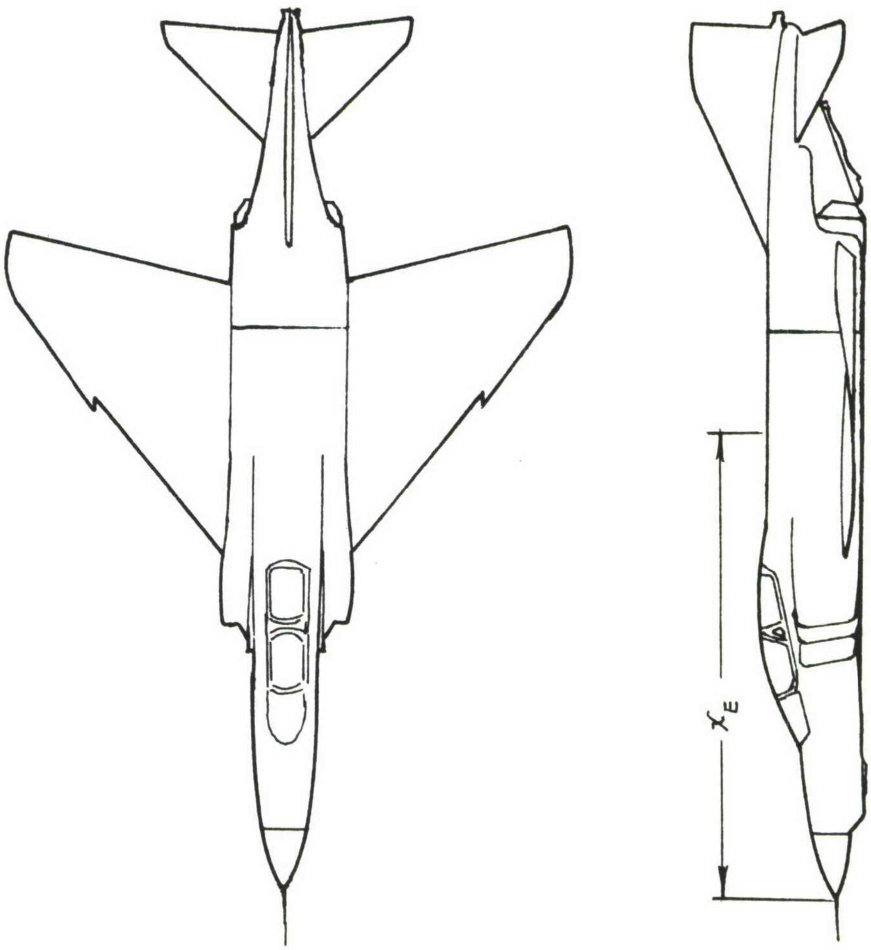


Figure 8. Location of Skin Response, RF-4C

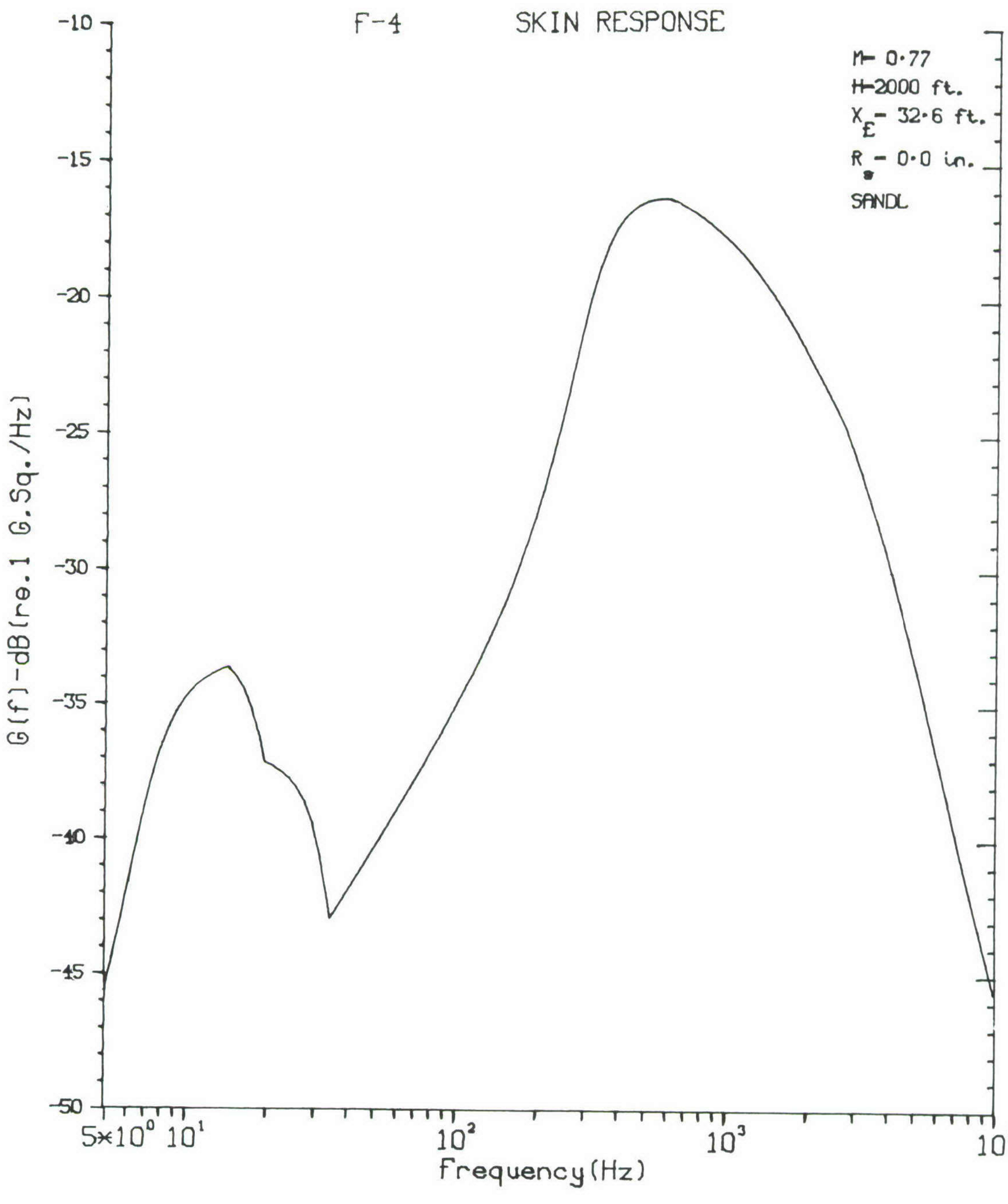


Figure 9. Predicted Response of Skin, RF-4C

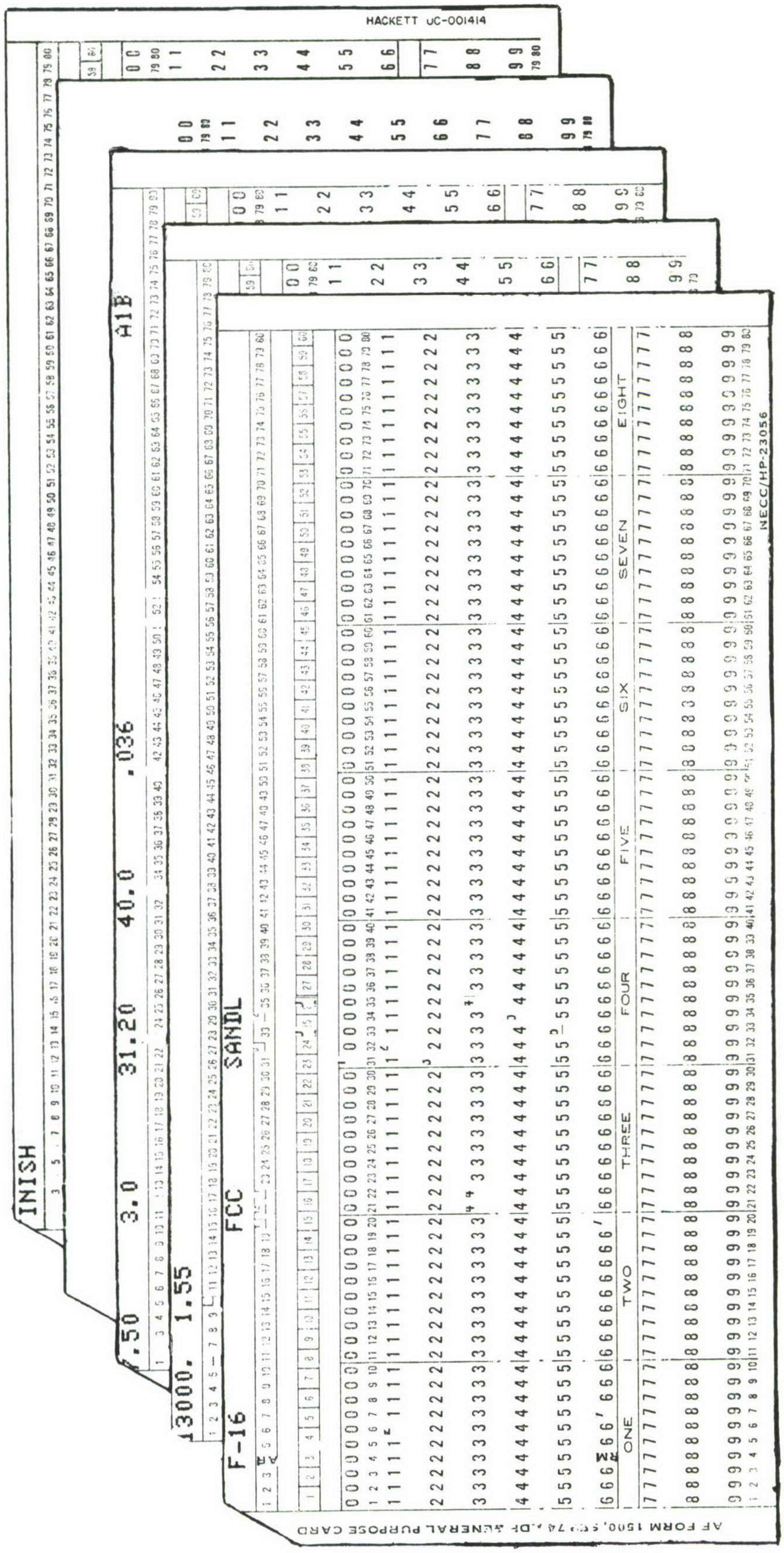


Figure 10. Input Data Cards, FCC, F-16

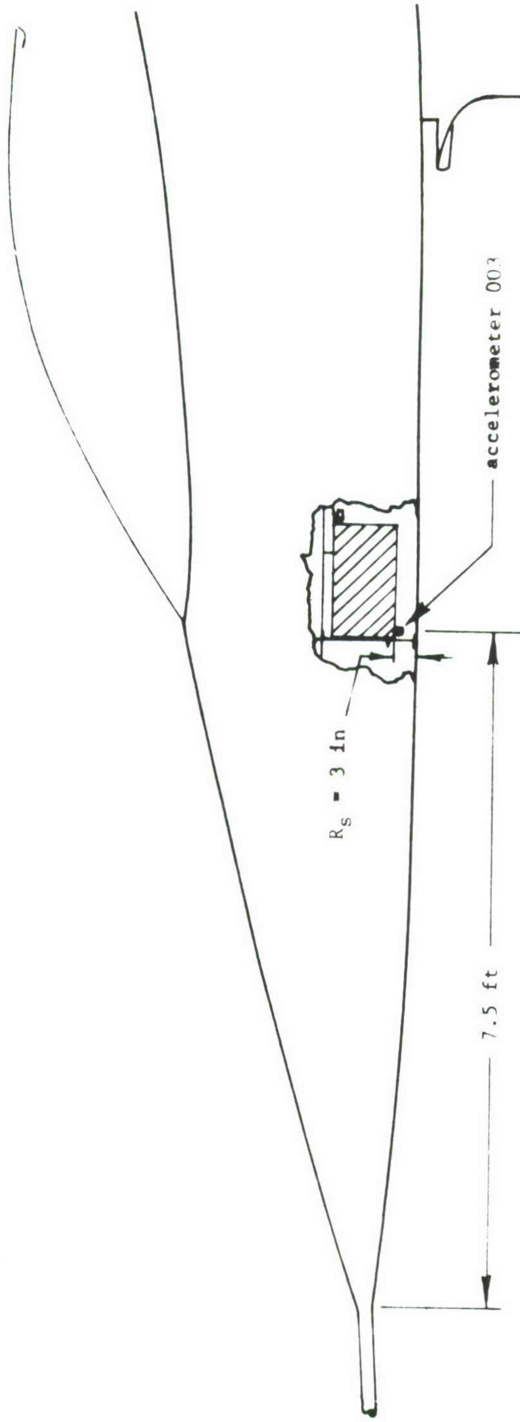


Figure 11. Location of Vibration Input to FCC, F-16

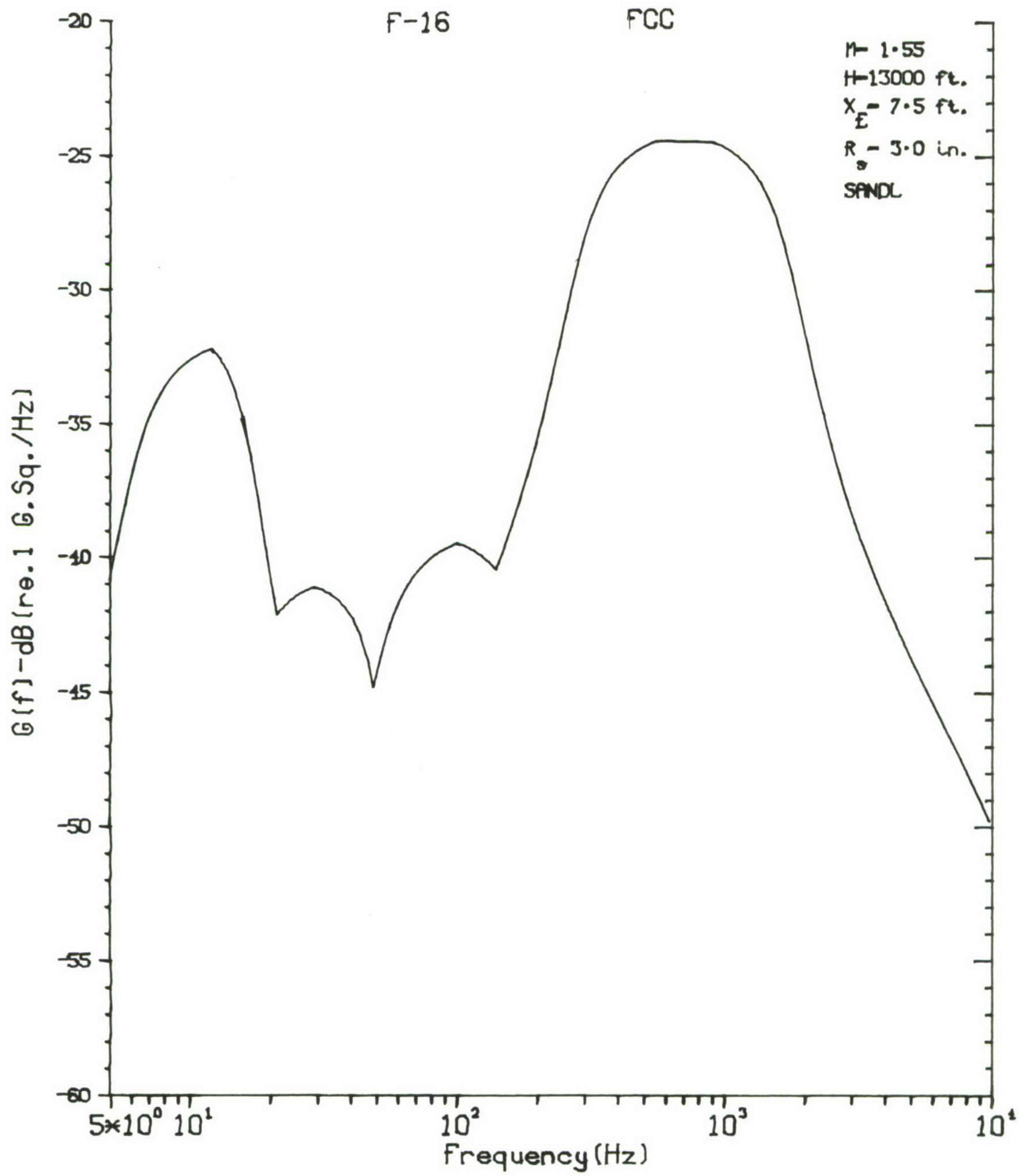


Figure 12. Predicted Vibration Input to FCC, F-16

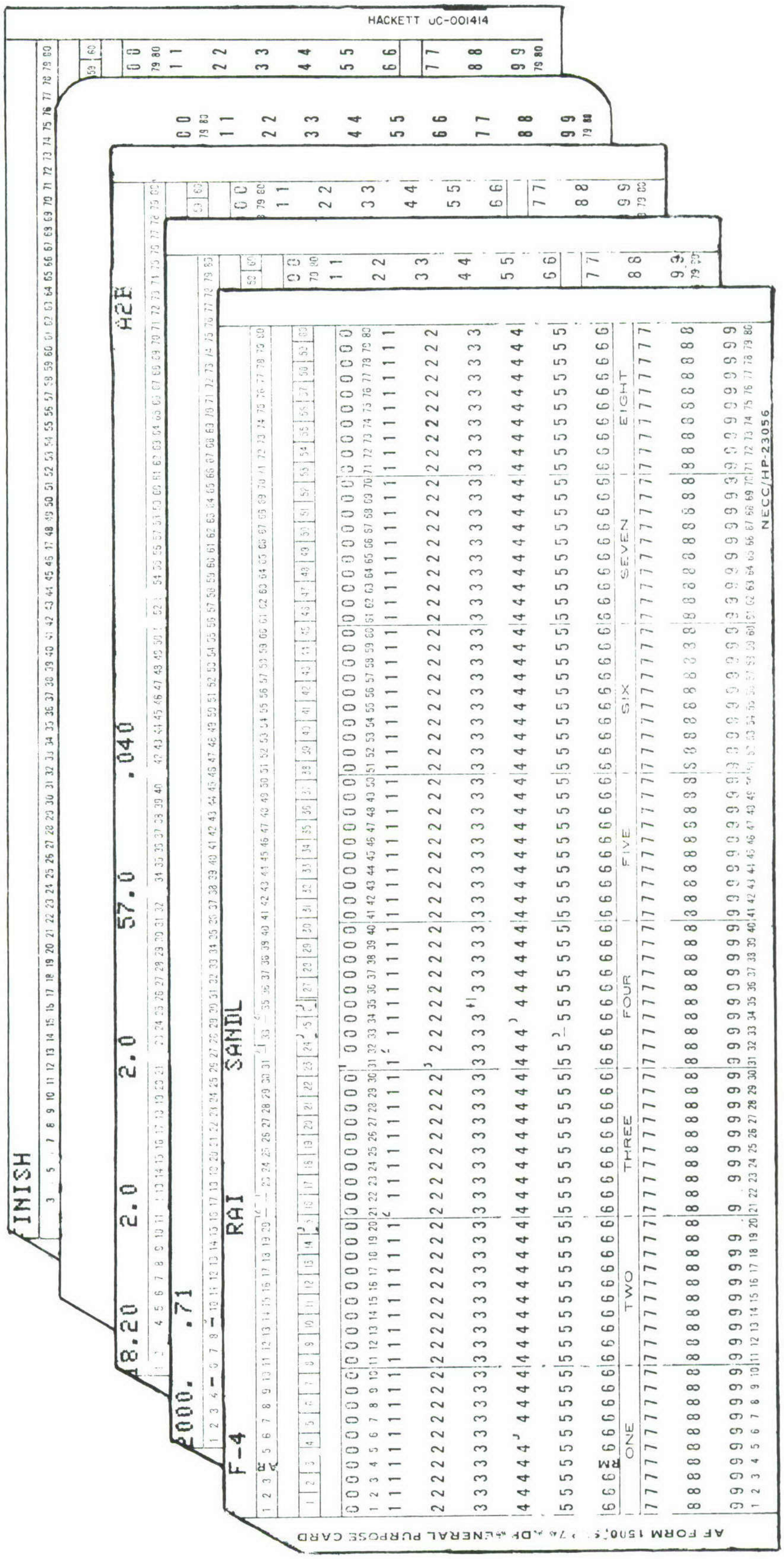


Figure 13. Input Data Cards, RAI, RF-4C

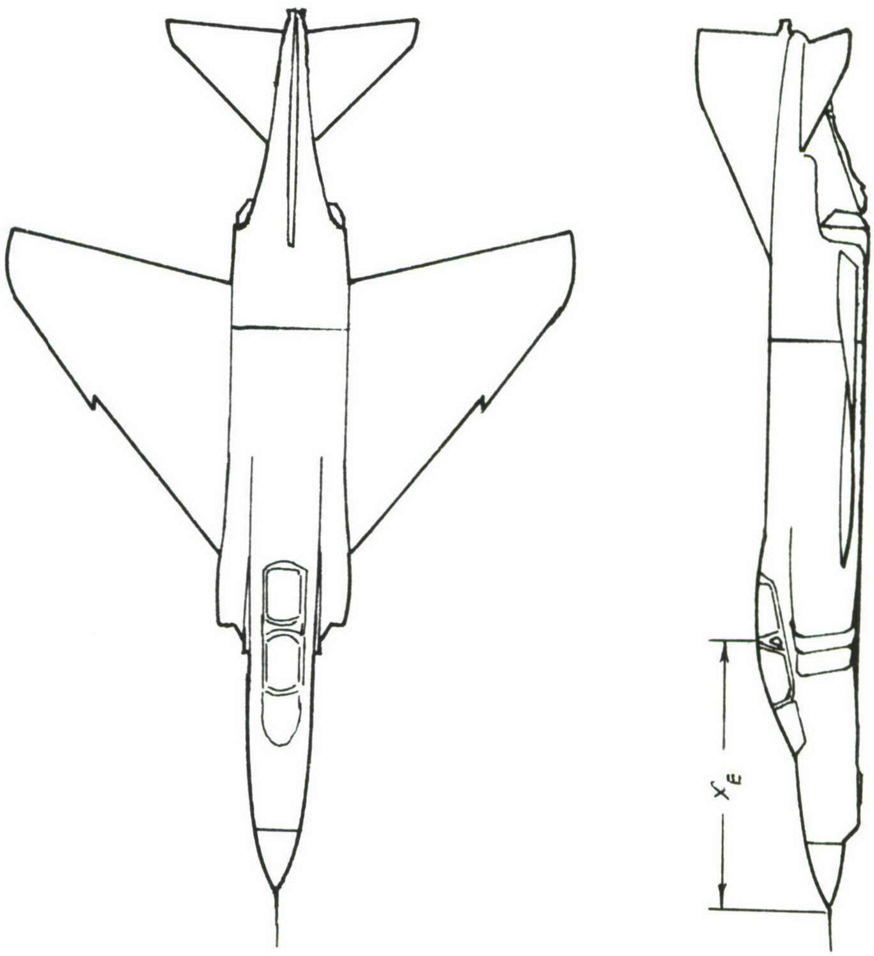


Figure 14. Location of RAI, Aft Instrument Panel, RF-4C

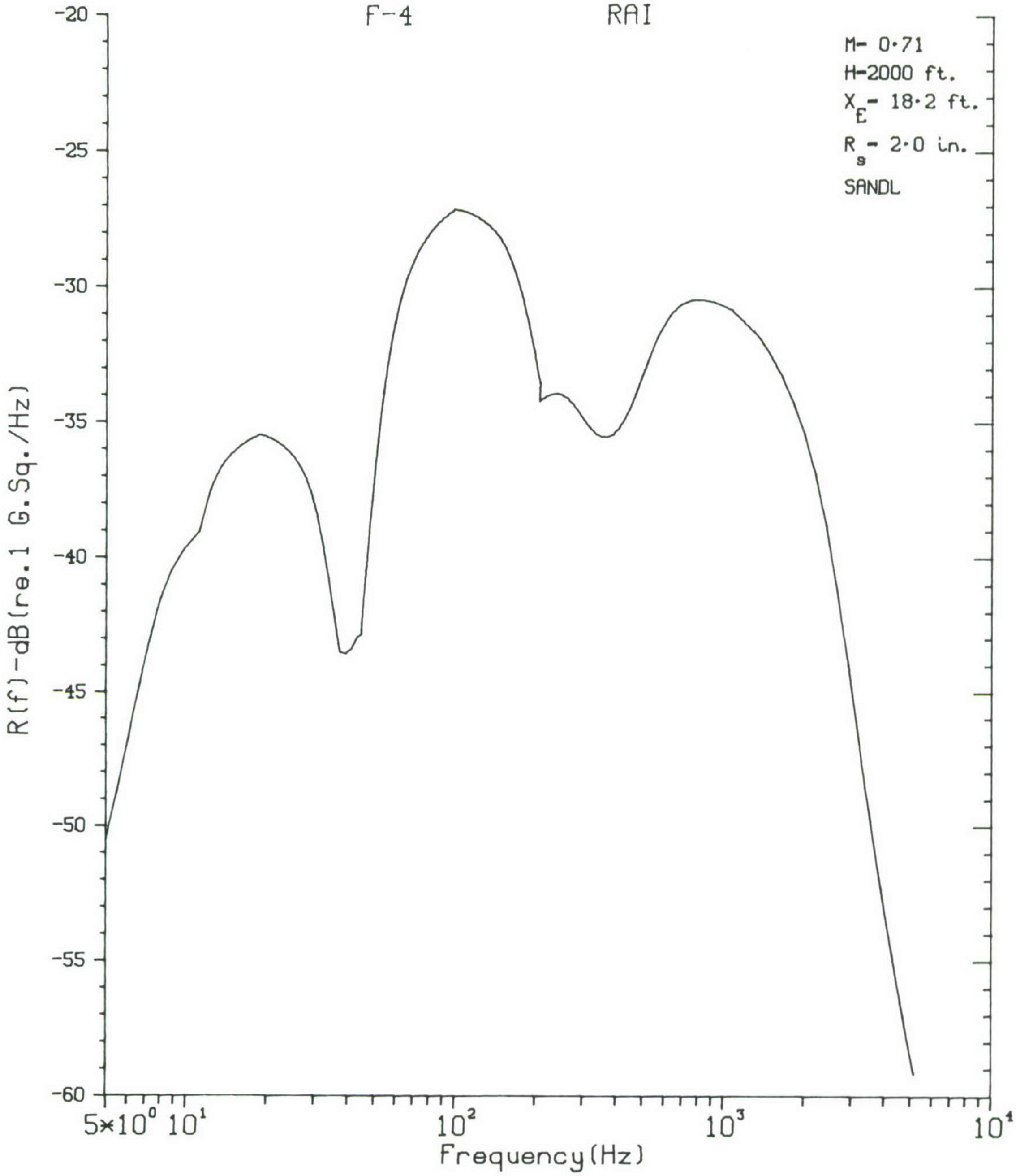


Figure 15. Predicted Vibration Input to RAI, Instrument Panel, Non-Isolated, RF-4C

F-4	RAI	SANDL
H =	2000.0	ALTITUDE (FT.)
M =	.71	MACH NO.
X_E =	18.20	DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMIC PROFILE (FT.)
R_S =	2.00	DISTANCE FROM SKIN (IN.)
W_E =	2.00	EQUIPMENT WEIGHT (LBS.)
T =	.0400	THICKNESS OF SKIN MATERIAL (IN.)
MATERIAL =	ALUMINUM	TYPE SKIN MATERIAL
CATEGORY =	2B	EQUIPMENT MOUNTING CATEGORY
D_F =	57.0	DIAMETER OF FUSELAGE (IN.)

All hard mounted secondary structures, of which non-isolated instrument panels are a member, involve decision criteria concerning the location of the equipment item along the mode shape of the instrument panel (see para 1.2 of Appendix E and Figure E-6). As it turns out $\varepsilon \geq \lambda/4$; so $R(f)$ has been selected, plotted and the results are shown in Figure 15. Note that if the user does not have a suitable estimate for the first bending mode frequency of the panel (f_{cIIb}) then he may refer to the recommended values in Table II, Section III.

1.4 A-7D (Instr. Panel, isolated)

The A-7D features an isolated instrument panel (isolator natural frequency, f_{cIIa}, is 45 Hz). This problem involves a Radio Frequency Indicator (RFI) mounted on the instrument panel (Figures 17 and 18). We wish to predict the indicator response during SANDL flight.

The inputs are:

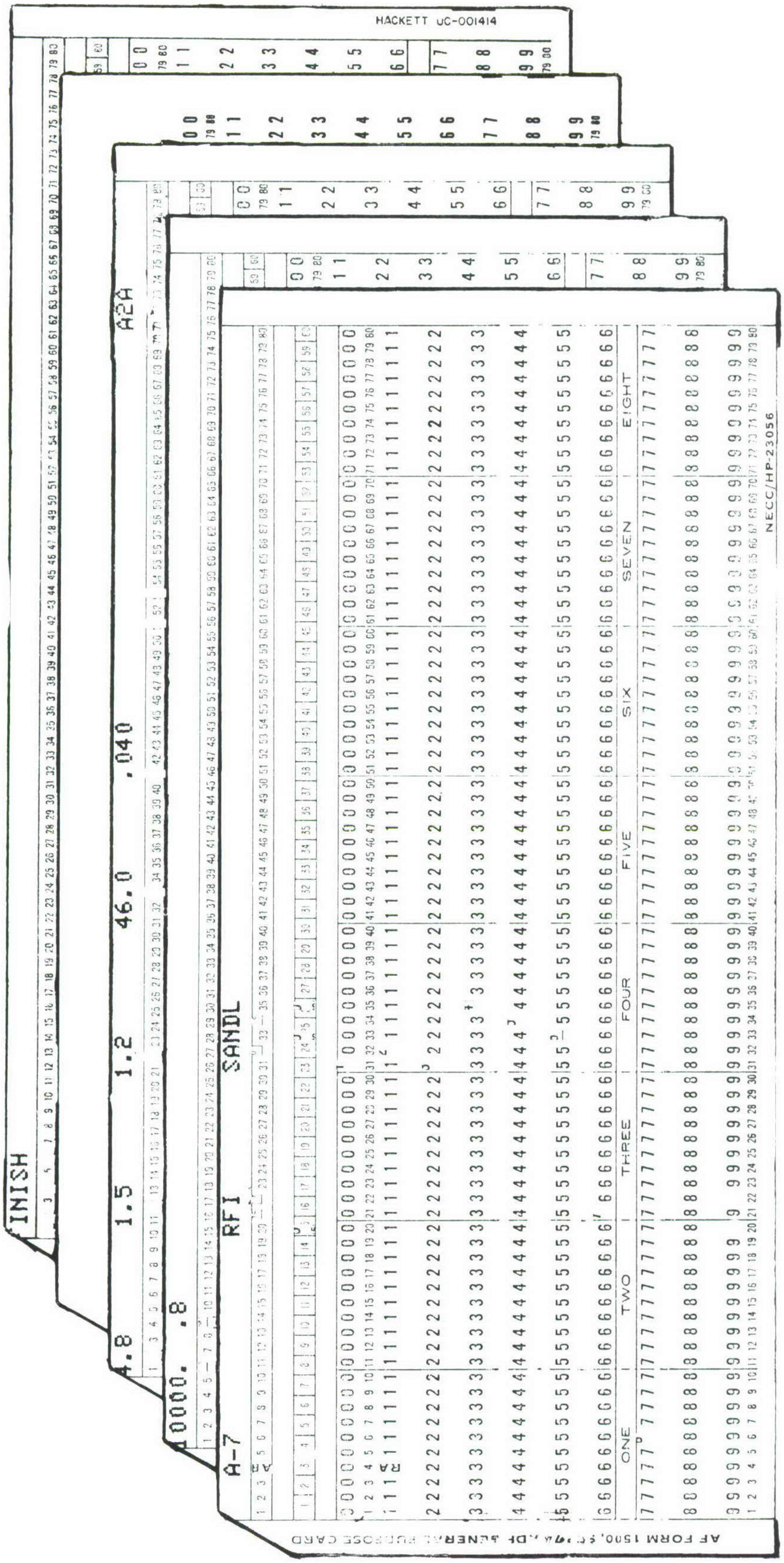


Figure 16. Input Data Cards, RFI, A-7D

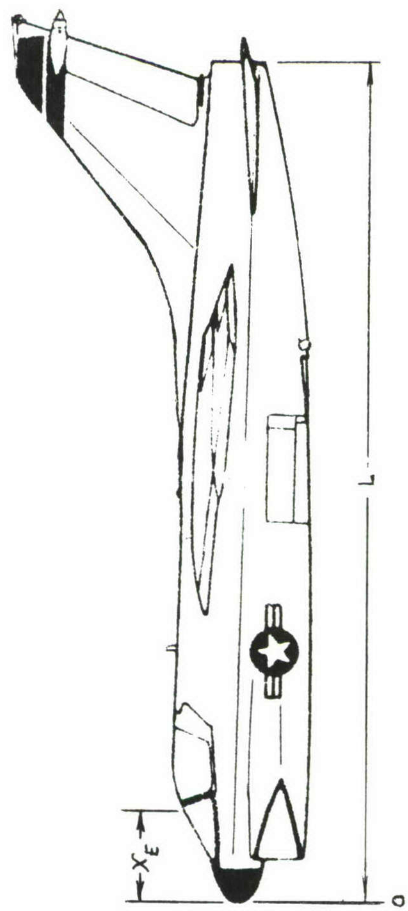


Figure 17. Location of RFI, Instrument Panel, Isolated, A-7D

A-7D	RFI	SANDL
H =	10000.0	ALTITUDE (FT.)
M =	.80	MACH NO.
X_E =	4.80	DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMIC PROFILE (FT.)
R_S =	1.50	DISTANCE FROM SKIN (IN.)
W_E =	1.20	EQUIPMENT WEIGHT (LBS.)
T =	.0400	THICKNESS OF SKIN MATERIAL (IN.)
MATERIAL =	ALUMINUM	TYPE SKIN MATERIAL
CATEGORY =	2A	EQUIPMENT MOUNTING CATEGORY
D_F =	46.0	DIAMETER OF FUSELAGE (IN.)

The predicted response of the instrument panel, or the input to the RFI, is shown in Figure 18.

1.5 F-15 (Black Box Input, Shock Mounted)

A black box assembly, consisting of the TACAN and the APX-76, is located in the nose region of the F-15 (Figure 20). The assembly is shock mounted. The isolator natural frequency is 25 Hz. We wish to predict the vibration input to the shock mounts for the SANDL case as well as for the buffet turn (BT).

The inputs are:

F-15	APX-76	BT
H =	25000.0	ALTITUDE (FT.)
M =	.90	MACH NO.
X_ε =	10.1	DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMIC PROFILE (FT.)
R_S =	5.00	DISTANCE FROM SKIN (IN.)
W_E =	54.00	EQUIPMENT WEIGHT (LBS.)
T =	.0400	THICKNESS OF SKIN MATERIAL (IN.)
MATERIAL =	ALUMINUM	TYPE SKIN MATERIAL
CATEGORY =	1B	EQUIPMENT MOUNTING CATEGORY
D_F =	40.0	DIAMETER OF FUSELAGE (IN.)

The entry condition for buffet turn is M=0.90 and H=25,000 ft. Note that the entry condition, or reference straight and level,

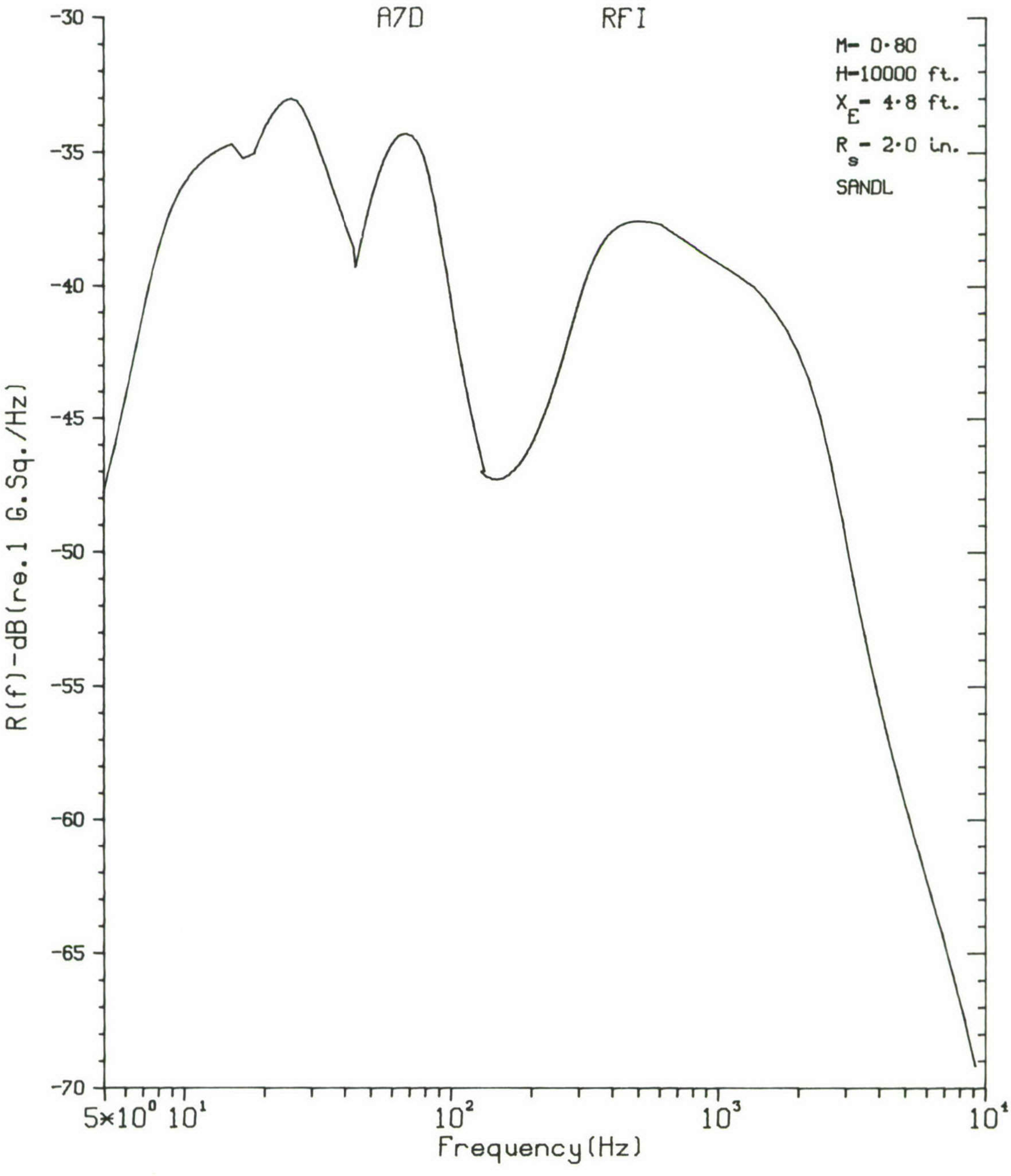


Figure 18. Predicted Vibration Input ot RFI, Instrument Panel, Isolated, A-7D

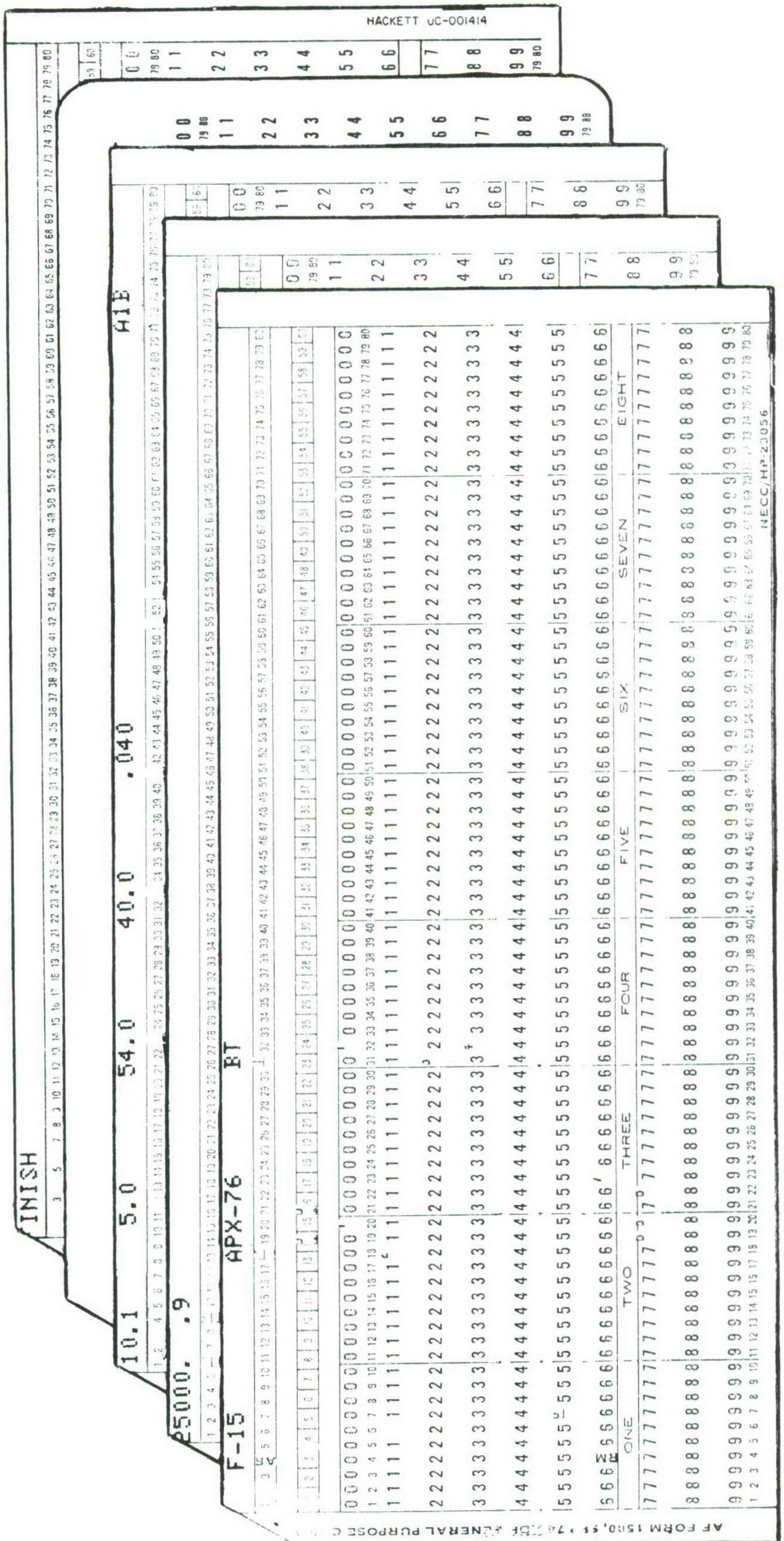


Figure 19. Input Data Cards, APX-76, F-15

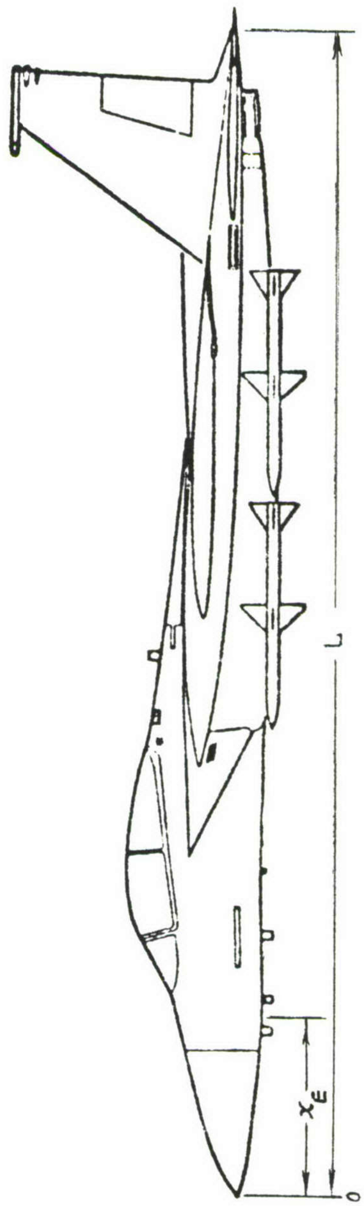


Figure 20. Location of APX-76, Isolated, F-15

is automatically plotted in the program along with the buffet turn curve (see para 3.1.2.1 of Section III). The resultant plots are shown as Figures 21 and 22. The impressive rise of the vibration level in the region of 35 Hz during buffet turn reminds us that severe spectral levels, though brief in duration, can be encountered ... and we add here, that they often go unnoticed by the vibration engineer.

1.6 F-15 (Black Box Response, Shock Mounted)

We repeat para 1.5, except now we wish to predict the response of the assembly mounted on the isolator. If we change category I(b) to I(a) and enter the isolator natural frequency as f_{cIa}=25Hz, we may then add the remaining inputs of para 1.5 to complete the program (Figure 23). The equipment response for entry (reference) SANDL and, finally, for BT is shown as Figures 24 and 25. Here, we see the equipment response -- an excitation magnified significantly by the isolator transfer function.

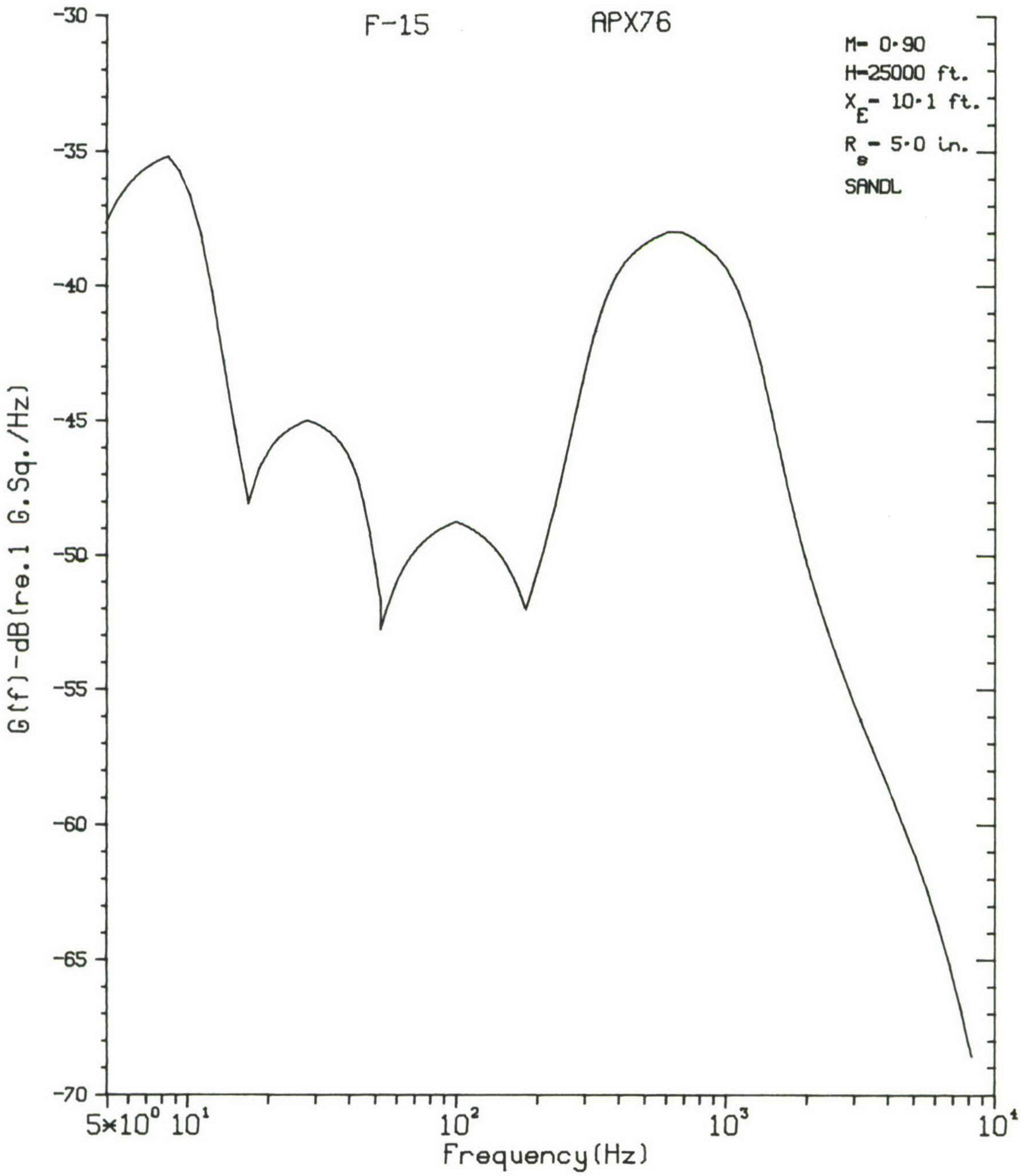


Figure 21. Predicted Input to APX-76, Isolated, F-15, for SANDL Flight

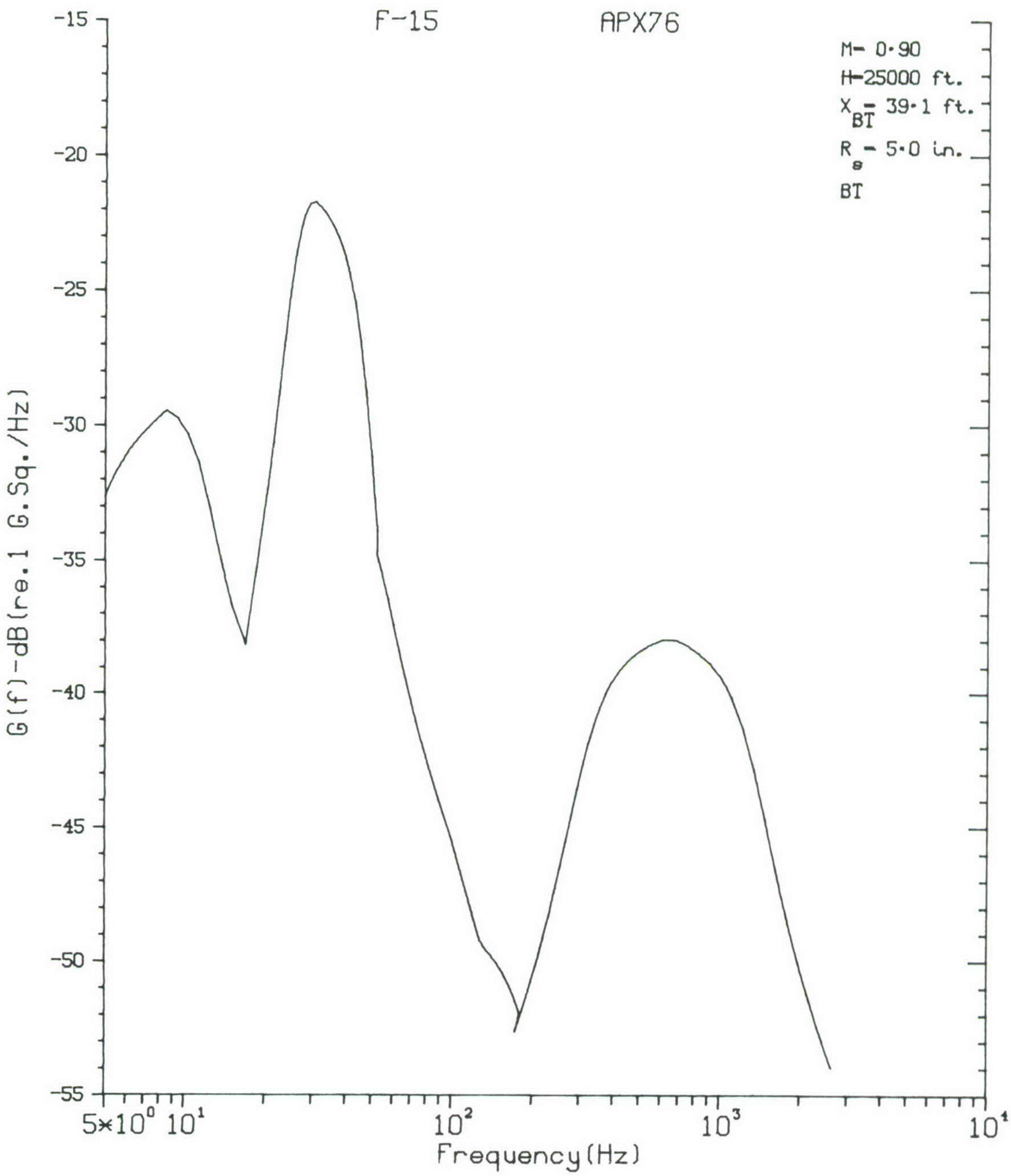


Figure 22. Predicted Input to APX-76, Isolated, F-15, for Buffet Turn

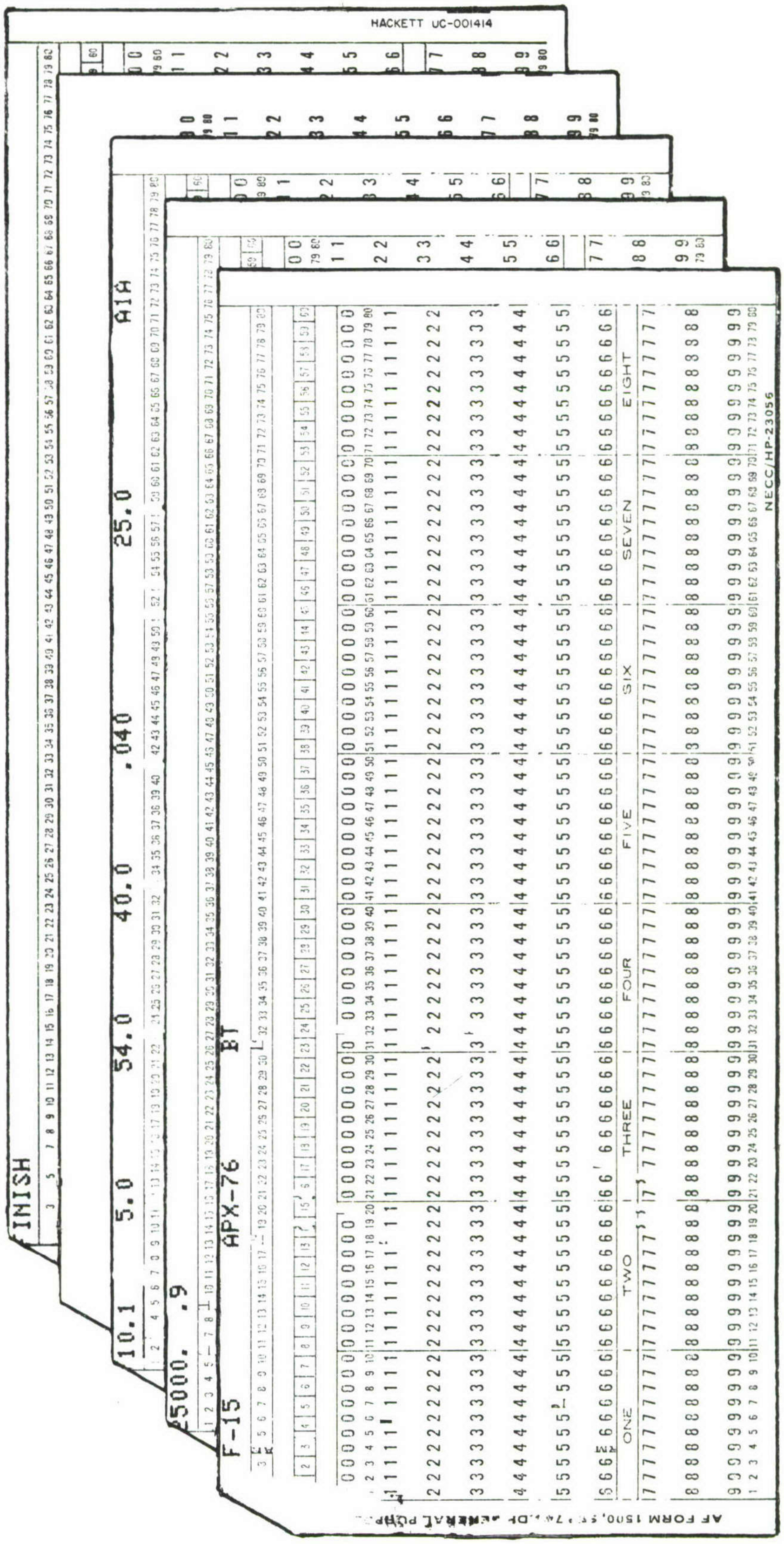


Figure 23. Input Data Cards, APX-76 Response, F-15

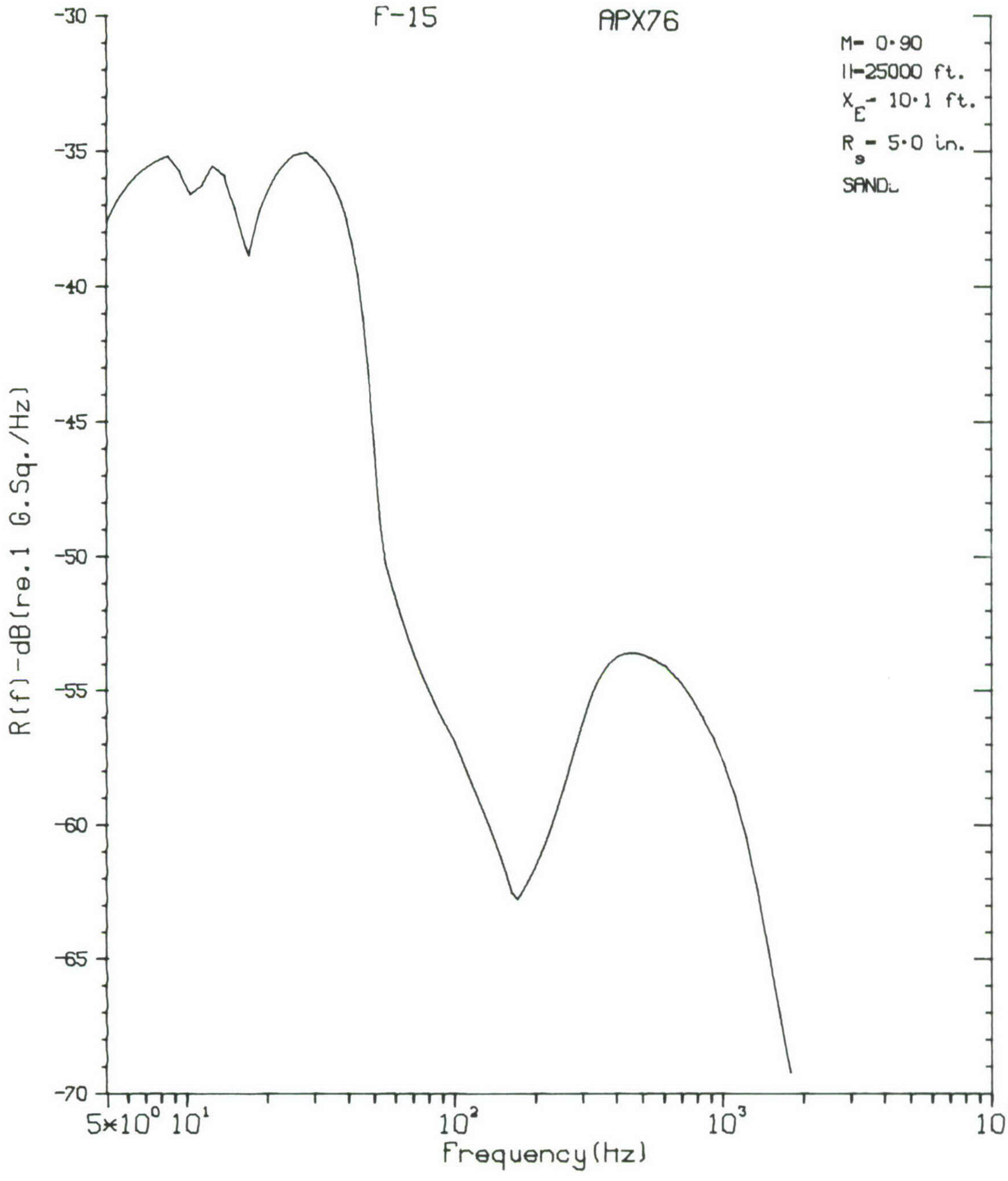


Figure 24. Predicted Response of APX-76, F-15, for SANDL Flight

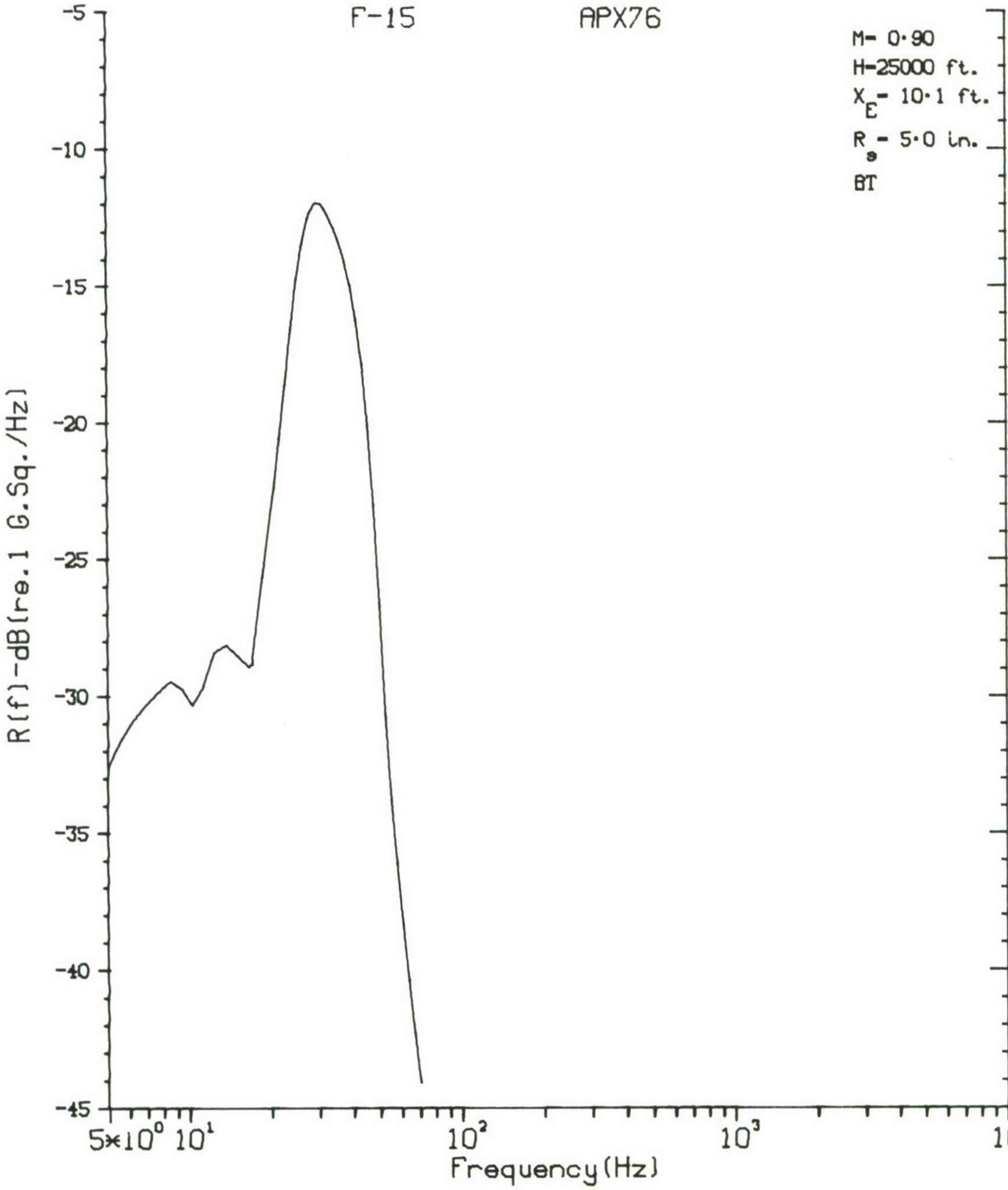


Figure 25. Predicted Response of APX-76, F-15 for Buffet Turn

SECTION V

REVIEW

1.0 Discussion

This work concludes with a discussion that briefly reviews the general philosophy of the prediction method, summarizes results thus far obtained, underlines some remnant problem areas or shortcomings, and finally, terminates with recommendations for future studies. Sections II and III show that, in the main, this prediction method employs the cross product of input and tranfer functions both of which are utilized as variants of a basic equation whose curve is fundamentally sigmoidal in form and plastic in temperament. Indeed, in this approach to vibration prediction, functions of a consummate virtuosity are all but mandatory -- and thus far, the flex function, thought often distended in the application, has yet to be breached in the trial. It will remain for future applications (probably involving other special flight conditions and physical configurations) to determine the ultimate limits of its adaptability; in the meantime, it seems to be working reasonably well.

But this prediction approach is not solely preoccupied with the manipulation of an abstruse function. The process is also shaped and otherwise supplemented with large doses of empiricism, chiefly in the form of vibration data which is looped back into the various functions (most notably, the special functions) to provide corrective

information resulting in readjustments of the function parameters. In general, the more relevant, the more detailed, and the more perceptive the data choice; the more accurate the results. We go further: the more details that are known about the aircraft skin, of the equipment mounting method, of the equipment size, shape, function, and weight, of the class of the equipment support structure used, of the equipment proximity to special and significant physical configurations (guns, flaps, speed brakes, landing gear, refueling doors, cavities) -- the more that is known of these specifics, the more readily transfer and special functions can be shaped, sized, and integrated into the prediction format to further the advance of a more realistic prediction end.

With these guidelines in mind, it is useful to review some deficient areas of the vibration data process and reflect on its consequences concerning the results of this prediction technique.

1.1 Instrument Panels

Extant vibration data covering instrument panels is relatively scarce, especially data from pickups that measure the input-output properties of the panel or data from response pickups that are located in the central one-third of the panel (central one-third of the half panel, if the panel is tied down at the center). Data indicating the panel weight, the mounting method (isolated or non-isolated) and the isolation frequency, if isolated, is nearly always unspecified and must be ascertained separately -- often at considerable difficulty. From these observations, it is easy to deduce that the

instrument panel transfer functions for the isolated and non-isolated case (Categories IIa and IIb) will, in all probability, be adjusted as additional suitable data becomes available. Finally, it is worth noting that instrument panel vibration, because of the severe levels, should be recorded, wherever possible, during violent flight phases such as buffet turn; especially for those aircraft whose cockpits are located near to, or over the wing areas.

1.2 Skin

Pickups on the skin are, sometimes, not skin mounted -- being mounted on adjacent frames, for example, and if they are placed at the central panel area, they are often of a size (mass) to roll off the high frequencies and so one must apply adjustments to the data in order to derive the transfer function (see Ref. 8). Despite these problems, the skin transfer function derived and used for this prediction process seems to be reasonably accurate for curved aluminum skin surfaces, forty thousandths of an inch thick. Suitable measurements on other type aircraft surfaces (including the wings) should be obtained, however, and much useful transfer function information can be developed for surfaces of greater thicknesses, and for that matter, surfaces of different geometry and composition. Boundary layer microphones remain a problem. They are usually massy; and, if anything, they (rather than accelerometers) are the ones to be moved over near the frame to reduce mass loading. Boundary layer microphone data are rarely accompanied with information indicating whether or not the data has been corrected for the boundary layer thickness and

the microphone effective diameter. The diameter is almost never indicated; but it should be. Sufficient spatial information (fuselage station, for example) should always be included with the microphone data in order that the down stream distance can be determined.

1.3 Buffet Turn

Vibration data covering the buffet turn (BT) maneuver is also rather hard to come by, thus the special function [S(f)] derived for the BT maneuver should be viewed as tentative; subject to future adjustments, if and when new data indicates. The general spectral characteristics occasioned by this maneuver, it is interesting to note, are similar to those generated during pullups; and if we are careful not to push the comparison too far, they are rather similar to such flight phases as lowered speed brakes, flaps, landing gears, and for that matter, open refueling doors and cavities. Processed data and extant vibration records should be sought and examined whenever opportunities arise to obtain valuable parametric information about these flight phases. Because quite apart from their being valuable contributions to the prediction process, the sudden bloom of their spectral peaks (as much as 25 dB!) provides instructive warning to equipment vibration and reliability engineers that straight and level vibration is only a part of the environmental history.

1.4 Forward Looking Radar Zones

The high frequency vibration fields of forward looking radar zones tends to be appreciably higher than the norm. The reasons for this seem to be due to the relatively empty air space

provided by the radome in combination with the low internal damping of the radome cover. Without the mass loading and lossy damping attenuations provided by the usual dense equipment packaging, this area, not surprisingly, will exhibit vibration levels (above 150 Hz) in excess of 6 to 10 dB above that of predicted levels. Because of this, $H_M(f)$ and $M_M(f)$ have been adjusted (in the program) to cover applications for equipment attached to forward looking radar bulkheads. Future additional data may indicate that further adjustments and improvements are desirable.

1.5 Sinusoidals

Sinusoidal-like vibration is present in various regions of the aircraft. It is found in the presence of blowers, pumps, generators, refrigeration units; and, most conspicuously, it is seen as one approaches the engine compartments. Here the vibration content may be fairly described as consisting of predominant sinusoids, superposed on a subordinate, random background. There is no provision in this method for this class of vibration; there should be.

1.6 Determining R_s

Normally, if the equipment is located on primary structure, R_s is chosen as the nearest distance from the aircraft skin to the equipment attachment point. Although this criteria may be modified as the method is applied more and more, the interpretation stated appears to be reasonably workable. However, its application to equipments attached to shelves and beams (secondary structure) is not so certain. At present, the author has chosen the nearest distance from the skin to the place (point) where the member attaches to the primary structure.

This criteria, too, could change in the future if repeated applications suggest.

1.7 Future Work Areas

The prediction method and its associated computer program may be readily extended to cover vehicle locations and in-service operations not covered in this report. The following flight conditions and configurations are considered to be sufficiently important from the vibration viewpoint to warrant future considerations, and are listed for review.

a. Speed brakes, pullups, flaps, landing gears, and open refueling door operations.

b. Gunfire.

c. Vertical fin vibration prediction.

d. Wing locations; including missiles and their launchers.

e. Cavities (ports and open weapons bay).

f. Stores and pylons.

APPENDIX A

AERODYNAMIC PROPERTIES

1.0 Equations

The properties of P(f) are determined from the following equations and procedures:

$$P_m(f) = \frac{(.007)^2 q^2 \delta_b}{(1+.14M^2)^2 U} \qquad \text{(A-1)}$$

$$f_{o'} = .61\ U/\delta_b \qquad \text{(A-2)}$$

$$\delta_b = \delta_o\ (\rho/\rho_o) \qquad \text{(A-3)}$$

$$\delta_o = 0.37xRe_x^{-1/5} \left[1 + \left(\frac{Re_x}{6.9 \times 10^7}\right)^2\right]^{1/10} \qquad \text{(A-4)}$$

where:

$P_m(f)$ = max value of P(f) (PSF^2/Hz)

q = dynamic pressure, $\rho\ U^2/_2$ (PSF)

δ_b = boundary layer thickness (ft)

M = Mach number

U = free stream velocity (ft/sec)

$f_{o'}$ = characteristic, or locator frequency of the flex function at the 6 dB down point (Hz)

δ_o = boundary layer thickness at zero altitude (ft)

ρ = mean density of air at flight altitude (slug/ft^3)

ρ_o = mean density of air at zero altitude (slug/ft^3)

x = distance downstream from the leading edge of the aerodynamic profile to the equipment location (ft)

$Re_x = U x/\nu$ = Reynolds number at distance x

ν = kinematic viscosity (ft^2/sec)

With the mach number and altitude given for straight and level flight (SANDL) the boundary layer parameters $P_m(f)$ and f_o are then determined. A graph (Figure A-1) is used to obtain β'. These three parameters, assigned to the flex function of Figure 6 of the main text, completely defines P(f). To obtain P(f), in dB, refer to the graph shown in Figure A-2. A typical example of a boundary layer pressure spectral density curve (P(f) as a function of frequency) is shown in Figure A-3.

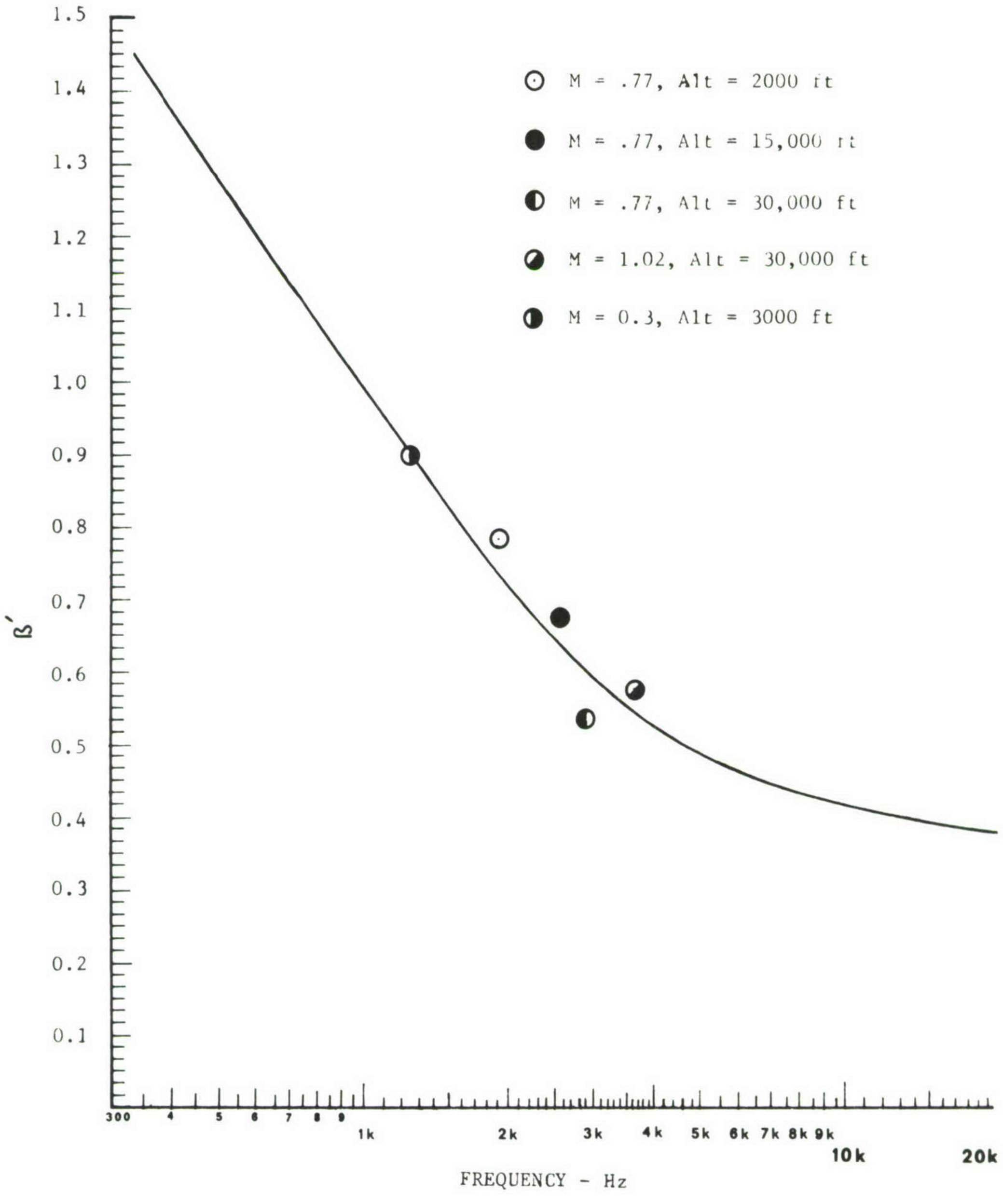


Figure A-1. The slope Factor, β', as a Function of f_o.

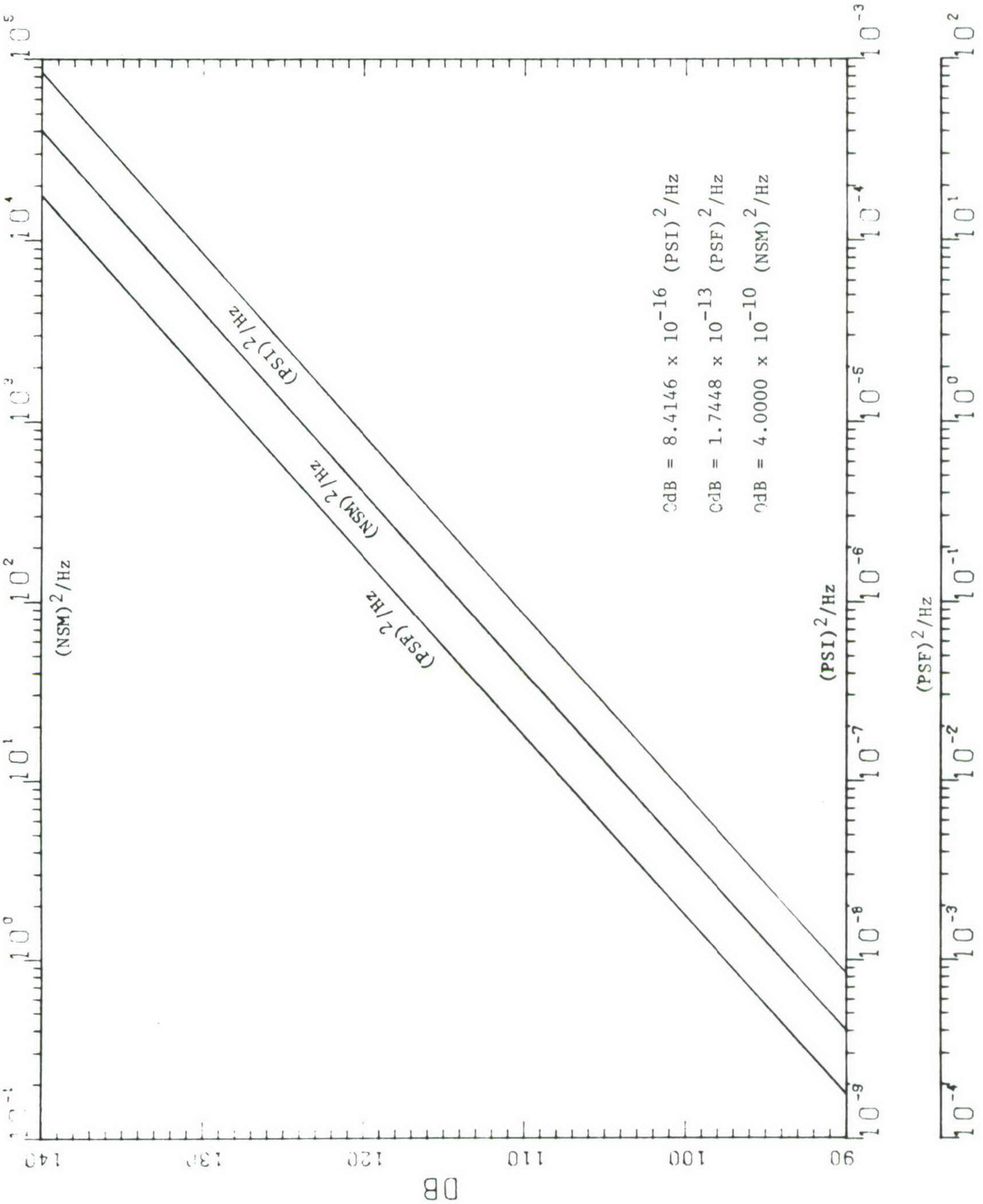


Figure A-2. Conversion Chart (dB as a Function of P(f))

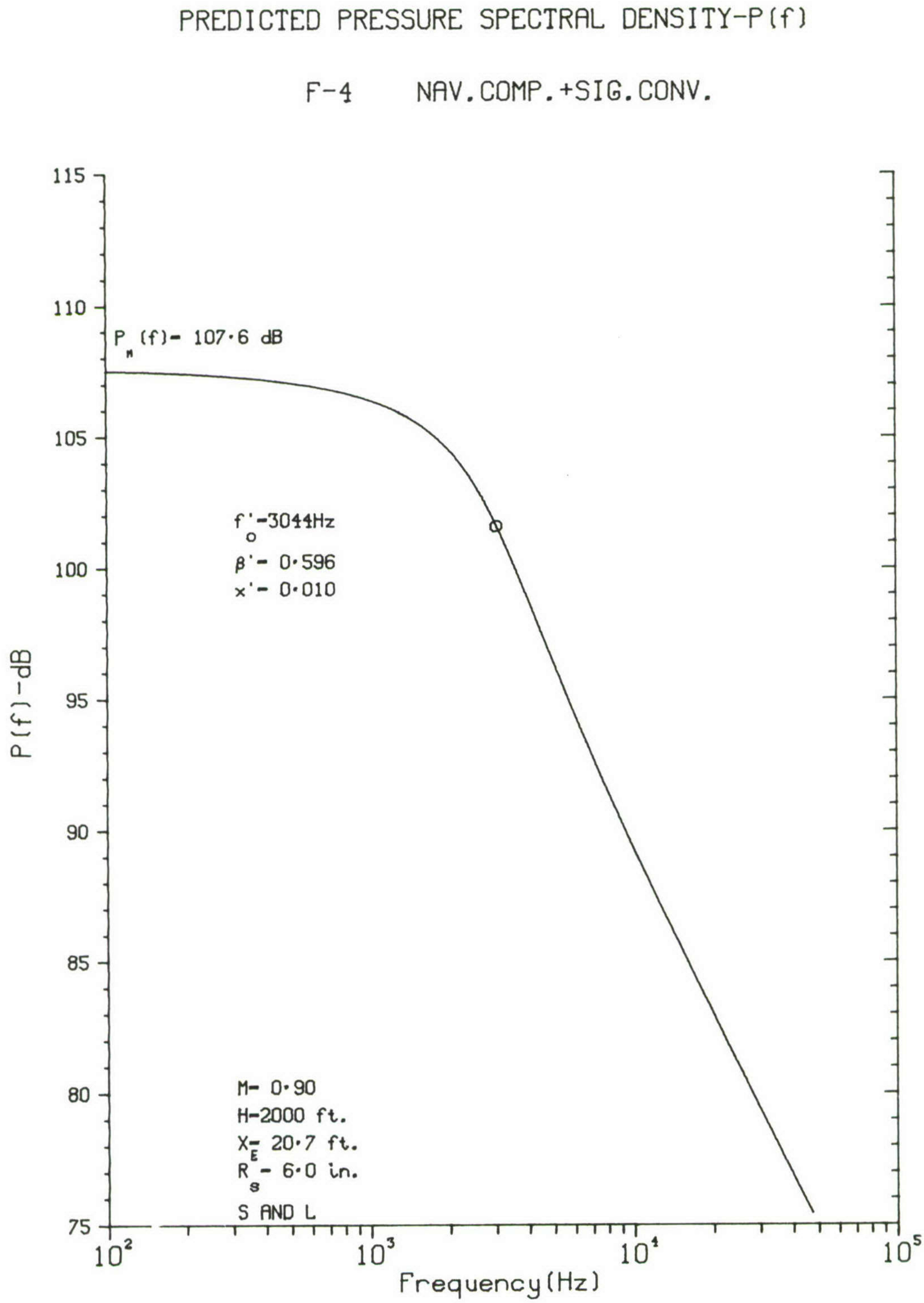


Figure A-3. Example of P(f) as a Function of Frequency

APPENDIX B

AIRCRAFT MODE SHAPES (FUSELAGE)

1.0 Terminology

The fuselage bending mode shapes are identified by the following symbolism: f_n = mode frequency (Hz)

$\phi_n(x)$ = normalized mode shape

FBBVS = first body bending, vertical, symmetric

SBBVS = second body bending, vertical, symmetric

x = aerodynamic distance downstream (inches)

L = maximum value of x (inches)

F.S. = aircraft fuselage station (inches)

2.0 Modal Shapes

Each deflection curve has been squared and normalized at the forward fuselage location corresponding to x=0. For some aircraft, x is approximately the same as the fuselage station; for others, it is not. Immediately following the two graphs of the first and second bending modes is a sideview of each aircraft that identifies the x and L parameters. Also included is a notation relating the x=0 coordinate to that of the aircraft fuselage station.

3.0 Derivation of Modal Properties

For fighter aircraft types not included in this Appendix, it will be necessary, as stated in Section III, to obtain the required modal properties and enter them into the program deck before the

prediction scheme can be utilized. The required modal shapes and frequencies are usually obtained from data abstracted from the aircraft ground vibration test report (GVT Report). The determination of $L_M(f)$ requires other strategems. In the absence of vibration data, $L_M(f)$ must be estimated. The procedure for this step is found in Reference 8 and is here repeated.

$$L_M(f) = A + 20 \log (L/B) + 40 \log (f_N/C) \tag{B-1}$$

where:

$L_M(f)$ = property to be determined

$A = L_M(f)$ for a known, similar fighter (dB)

L = length of the new aircraft (inches)

B = length of a known, similar aircraft (inches)

f_n = frequency, FBBVS, of the new aircraft (Hz)

C = frequency, FBBVS, of a known, similar aircraft (Hz)

The maximum value of the low frequency transfer function, $L_2(f)_M$, may be estimated using the following relationship.

$$L_2(f)_M = L_M(f) - 6 \tag{B-2}$$

where adequate vibration data is available more desirable results may be achieved by noting G(f) (during SANDL flight) and, through the use of equation 14 (Section II), solving for $L_M(f)$.

$$P(f)\ [\phi_n(x) L_M(f)] = G(f)$$

and, (B-3)

$$L_M(f) = \frac{G(f)}{P(f)\phi_n(x)}$$

Note that this procedure requires that the first bending mode shape be determined. Also, best results are obtained if one selects G(f) proximate to x=0 where the mode response is large and usually conspicuous. $L_2(f)_M$ may be determined by the response of the second bending mode G(f), relative to the first bending mode value.

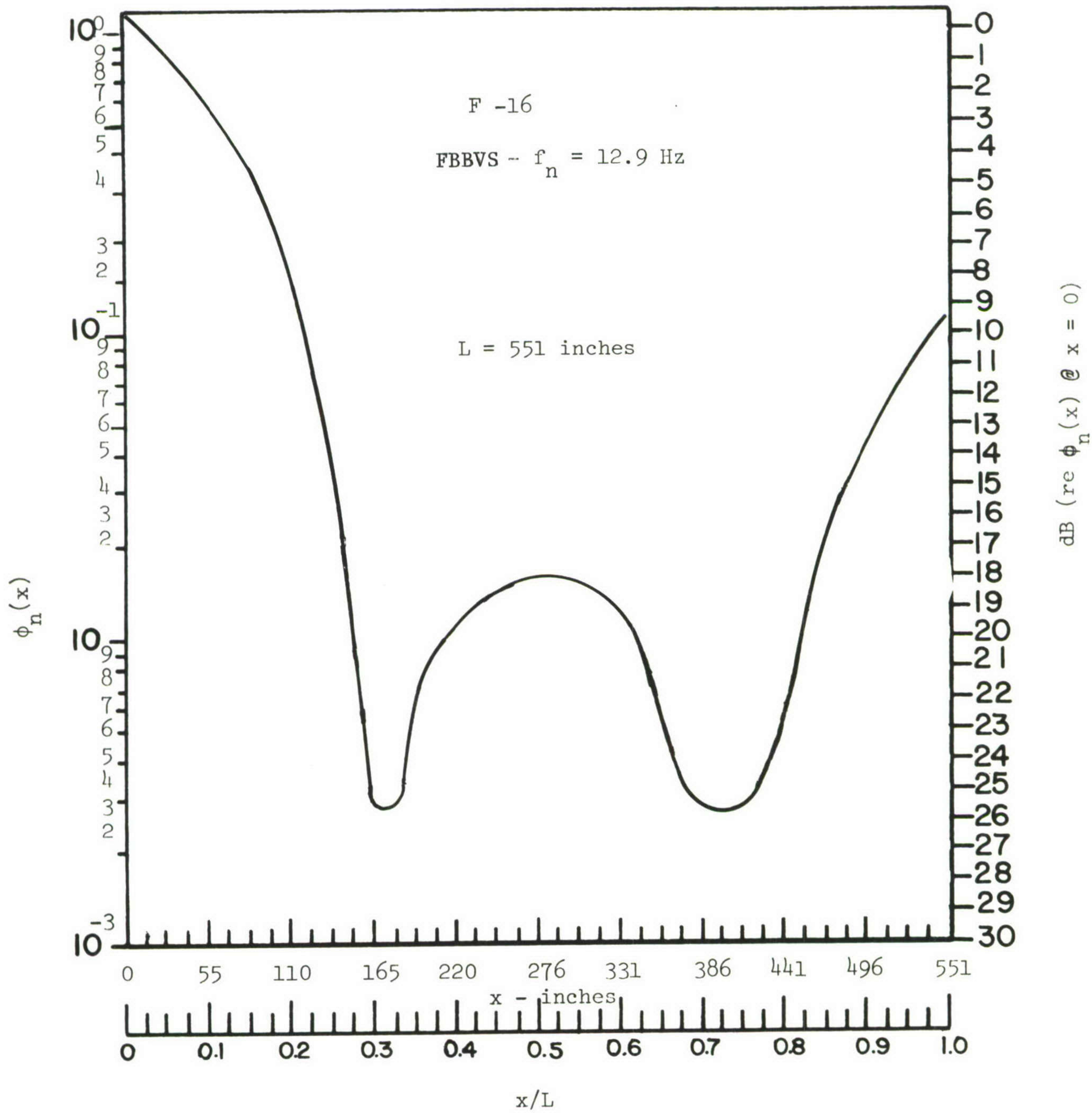


Figure B-1. Mode Shape (FBBVS) of the F-16

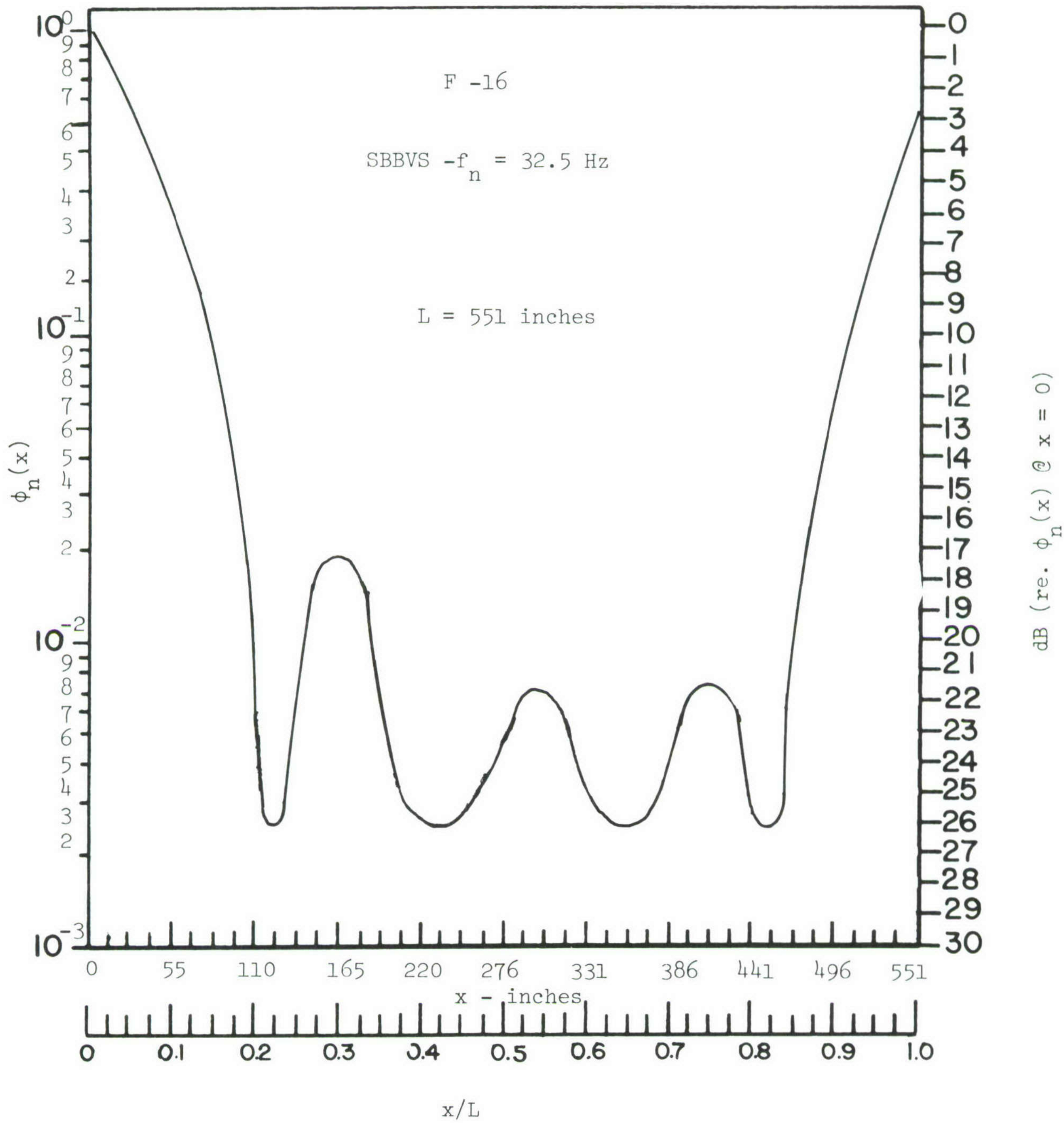
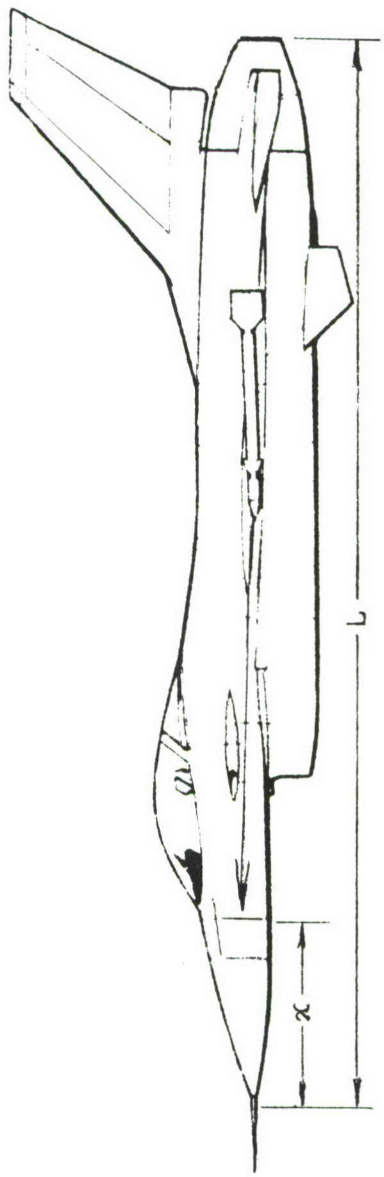


Figure B-2. Mode Shape (SBBVS) of the F-16



Note: x=0 is equivalent to F.S. = 0 inches

Figure B-3. F-16 Aircraft Showing the x and L Parameters

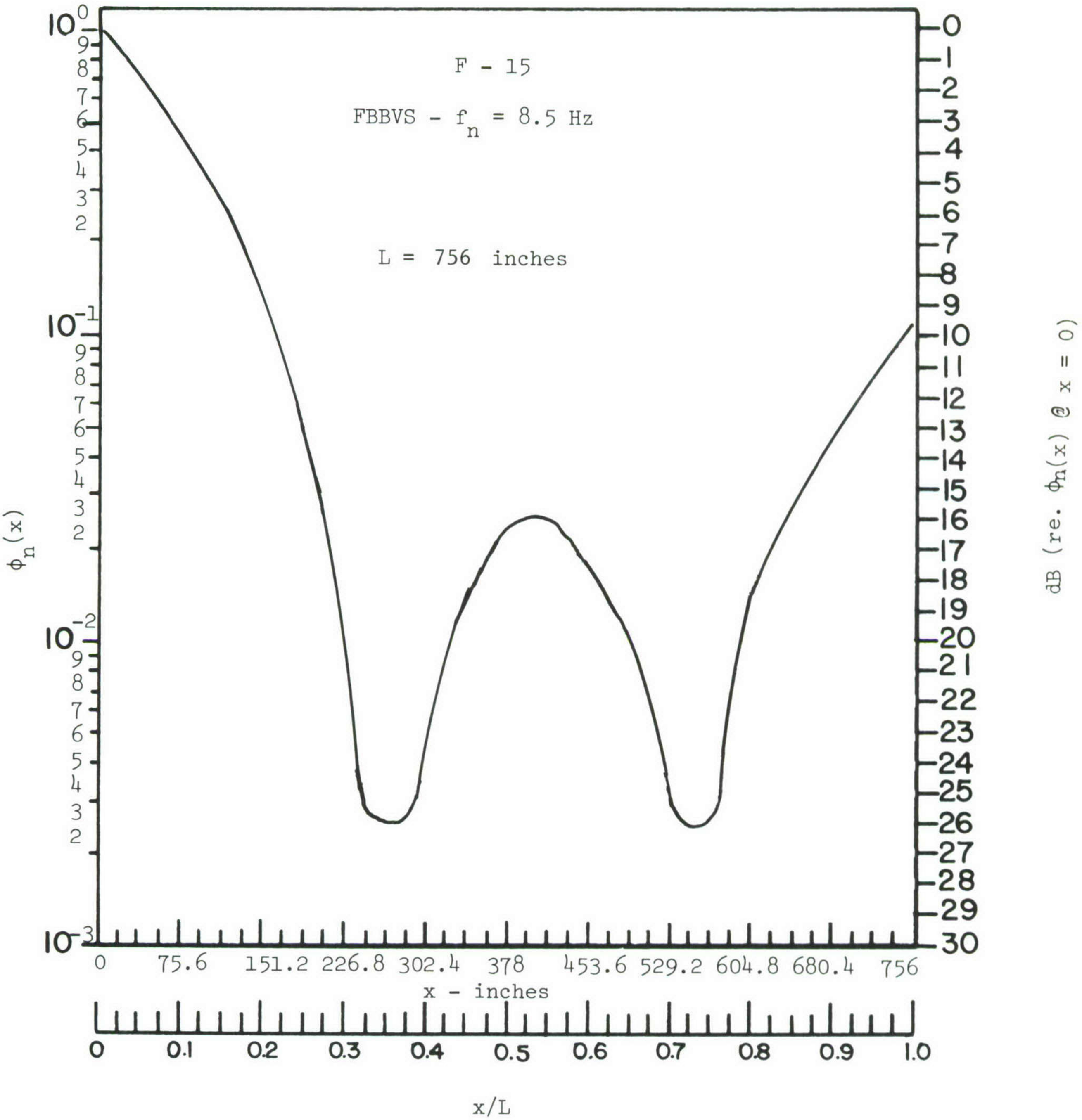


Figure B-4. Mode Shape (FBBVS) of the F-15

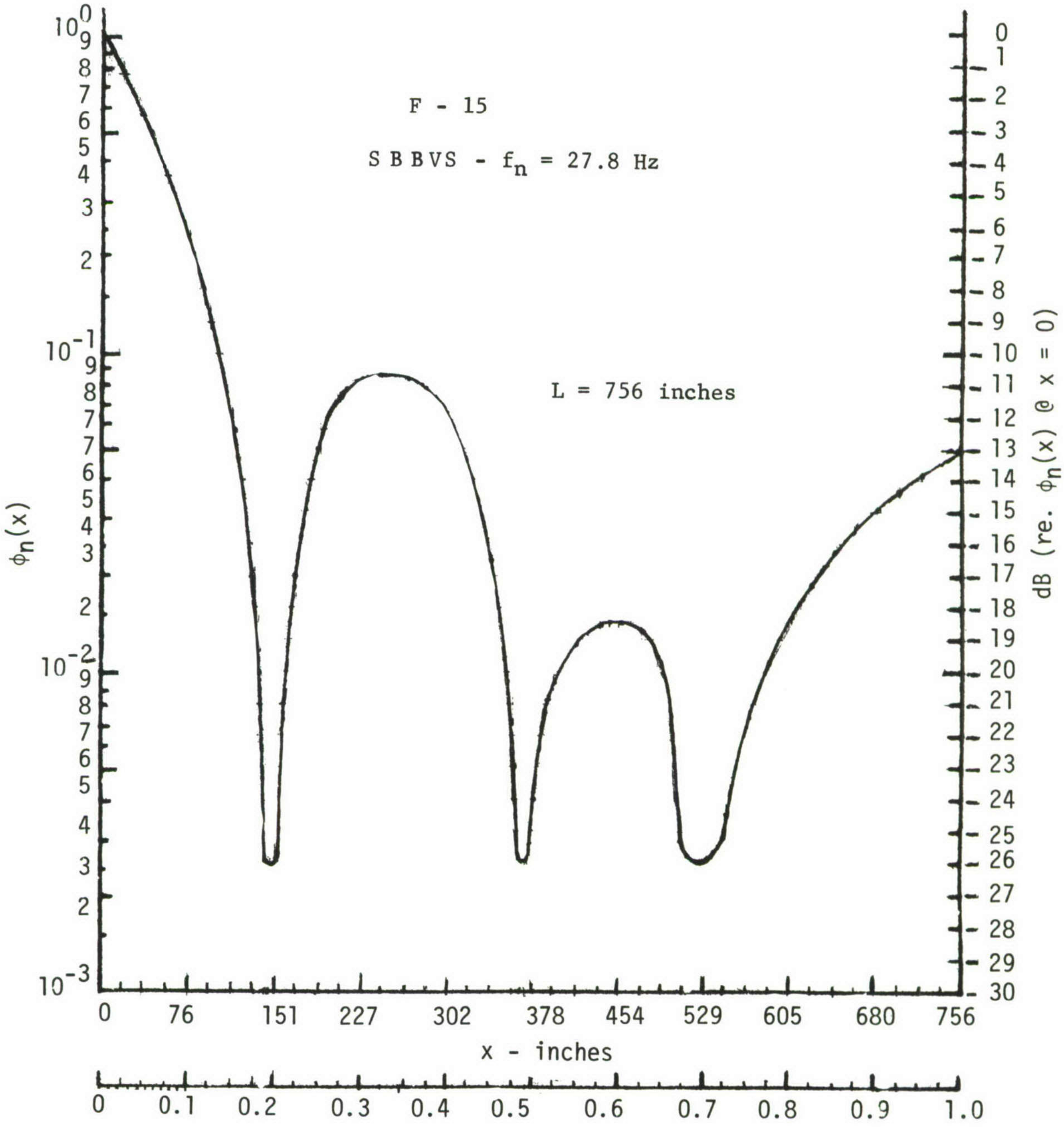
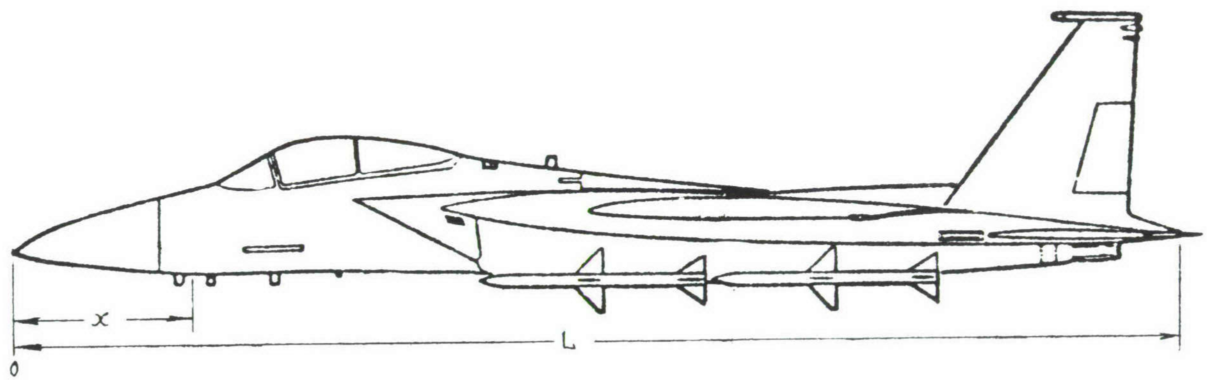


Figure B-5. Mode Shape (SBBVS) of the F-15



Note: x=0 is equivalent to F.S. = 116 inches

Figure B-6. F-15 Aircraft Showing the x and L Parameters

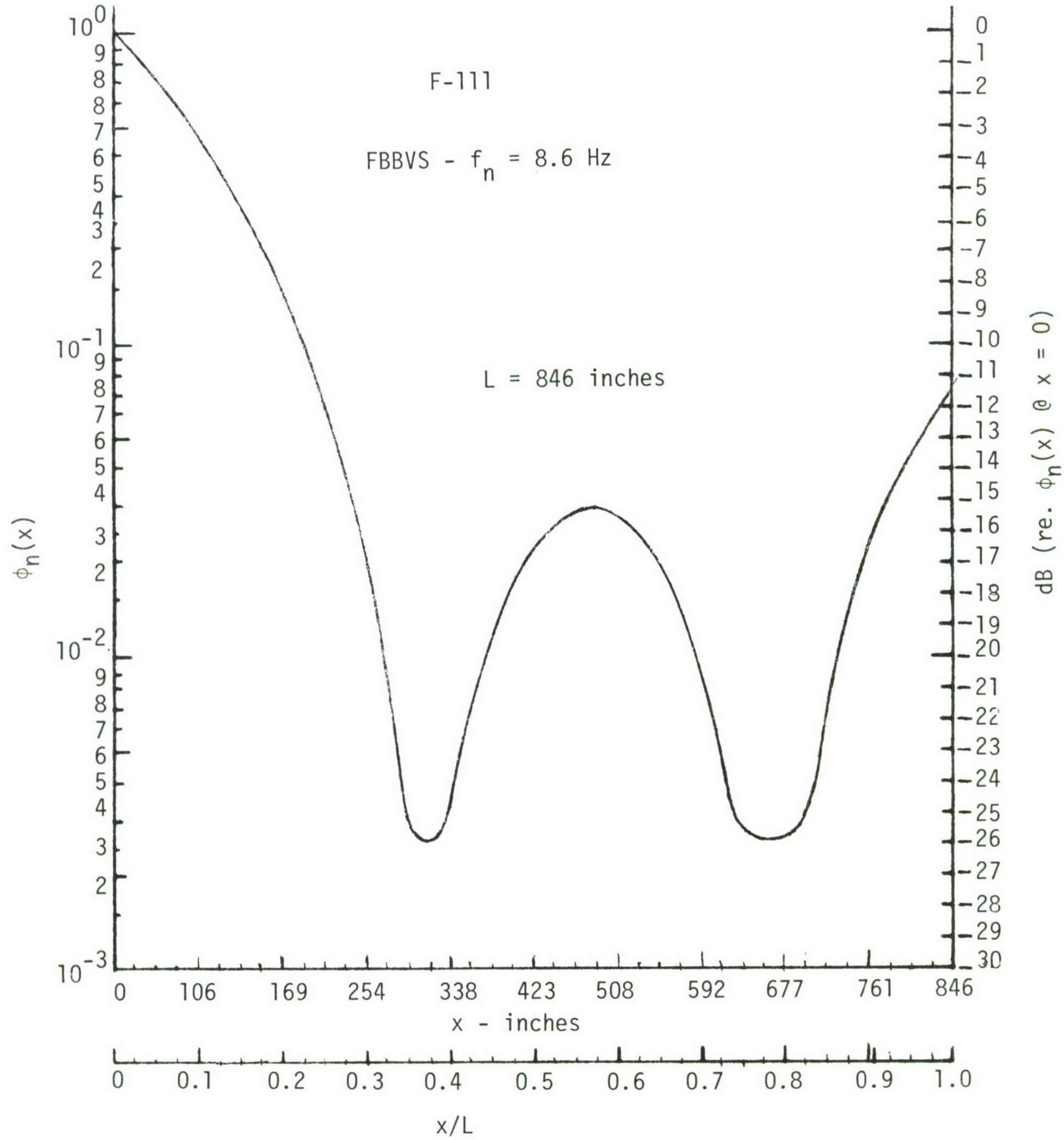
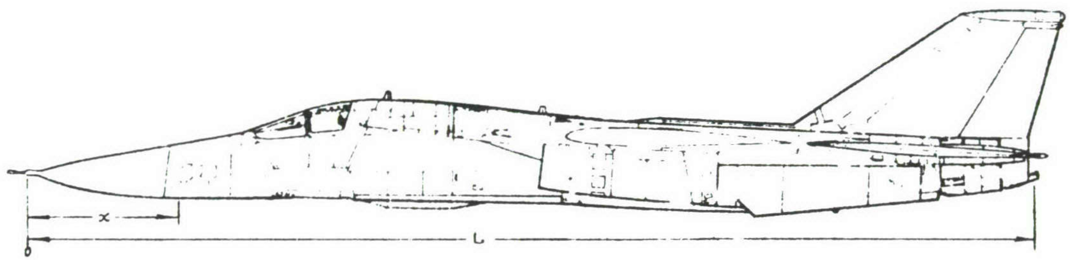


Figure B-7. Mode Shape (FBBVS) of the F-111



Note: x=0 is equivalent to F.S. = 0 inches

Figure B-8. F-111 Aircraft Showing the x and L Parameters

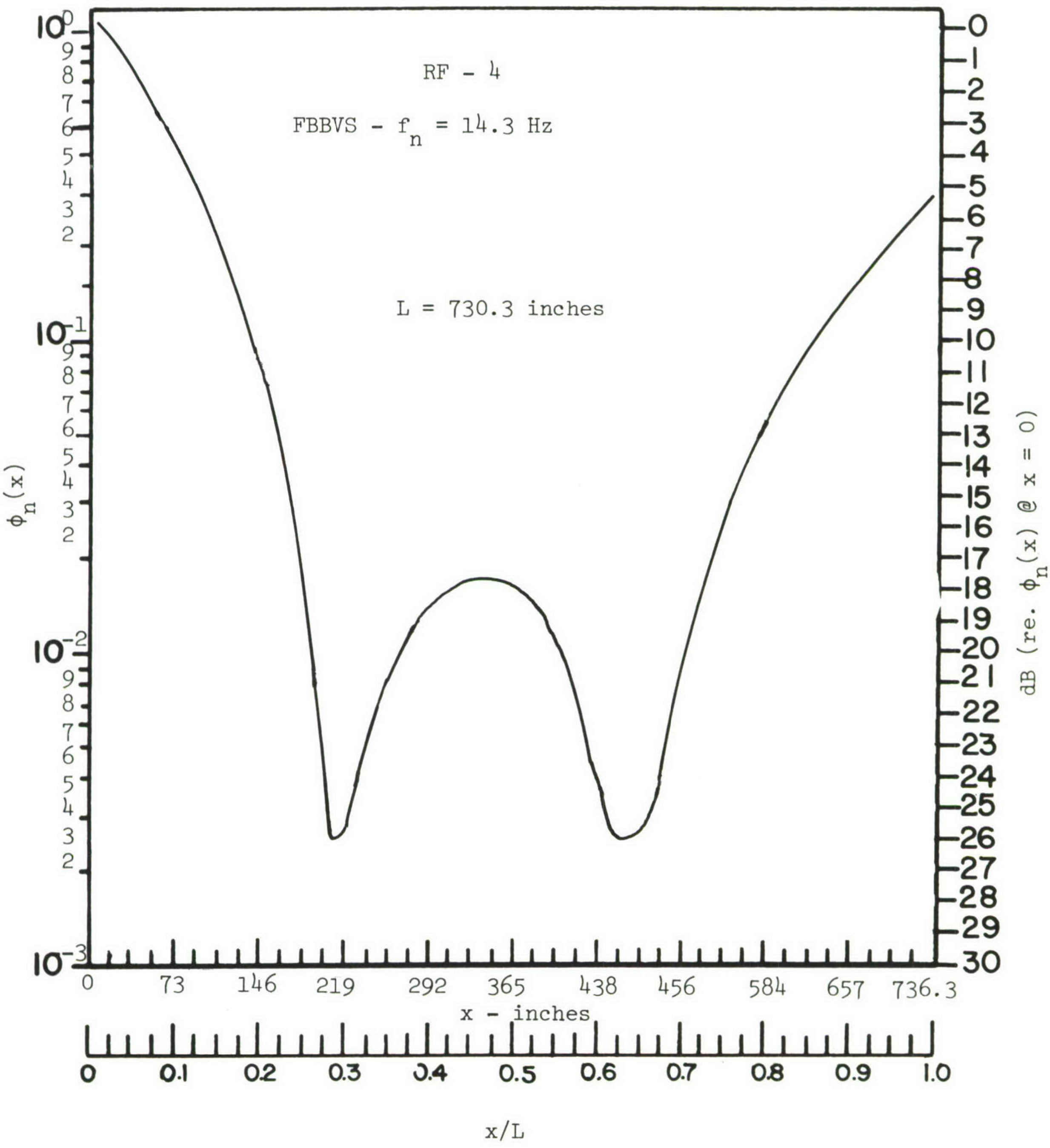


Figure B-9. Mode Shape (FBBVS) of the RF-4C

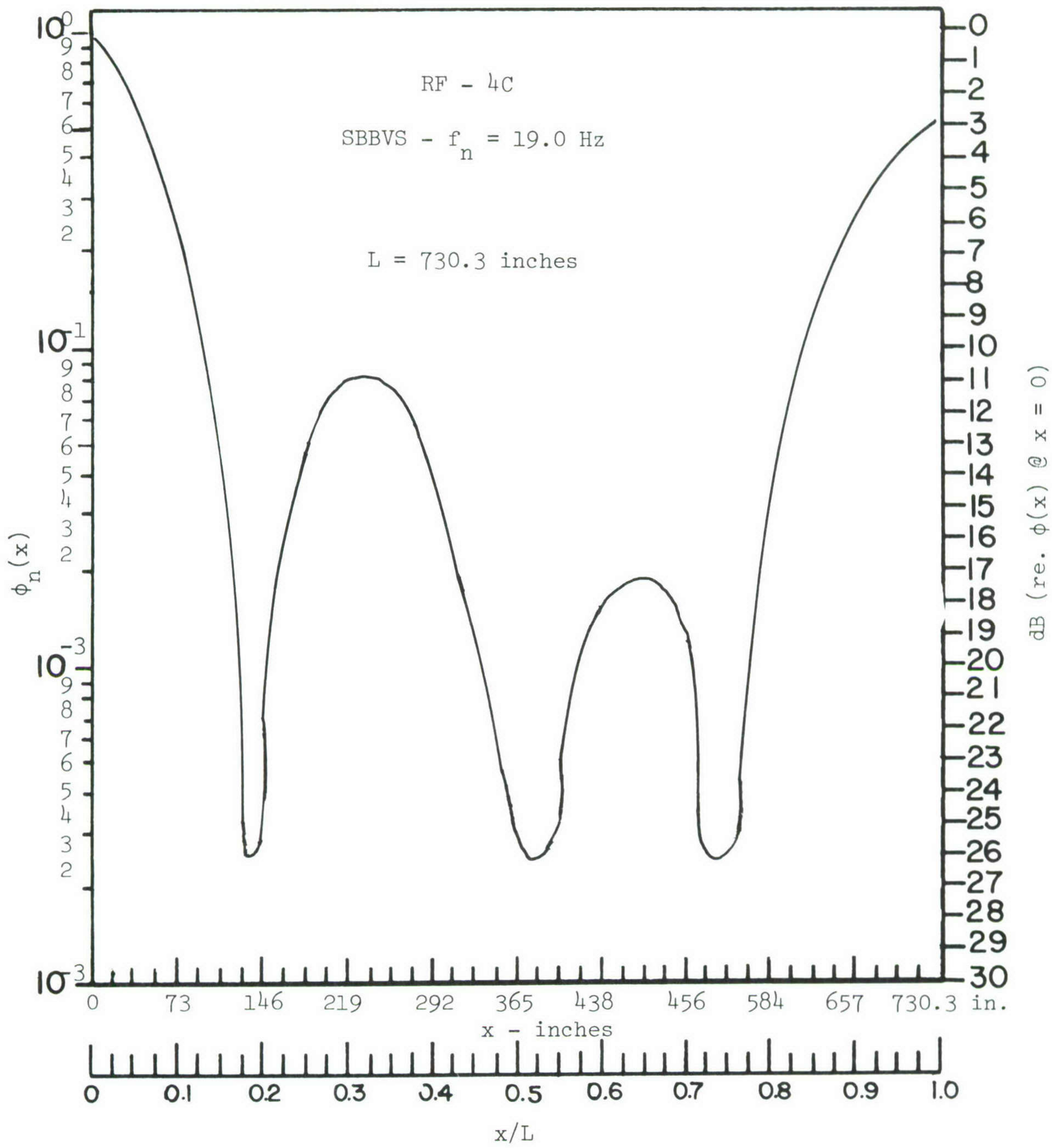
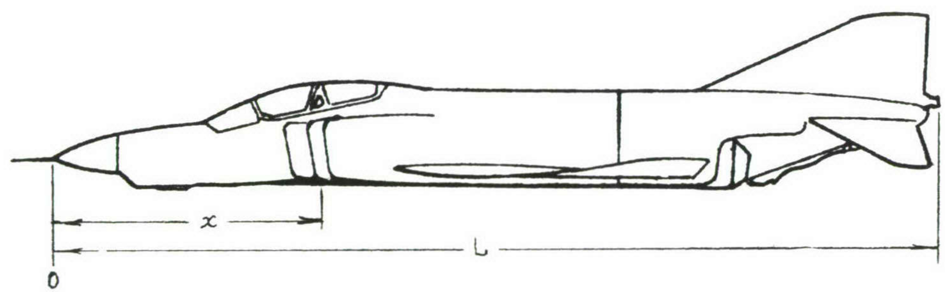


Figure B-10. Mode Shape (SBBVS) of the RF-4C



Note: x=0 is equivalent to F.S. = -59 inches

Figure B-11. RF-4C Aircraft Showing the x and L Parameters

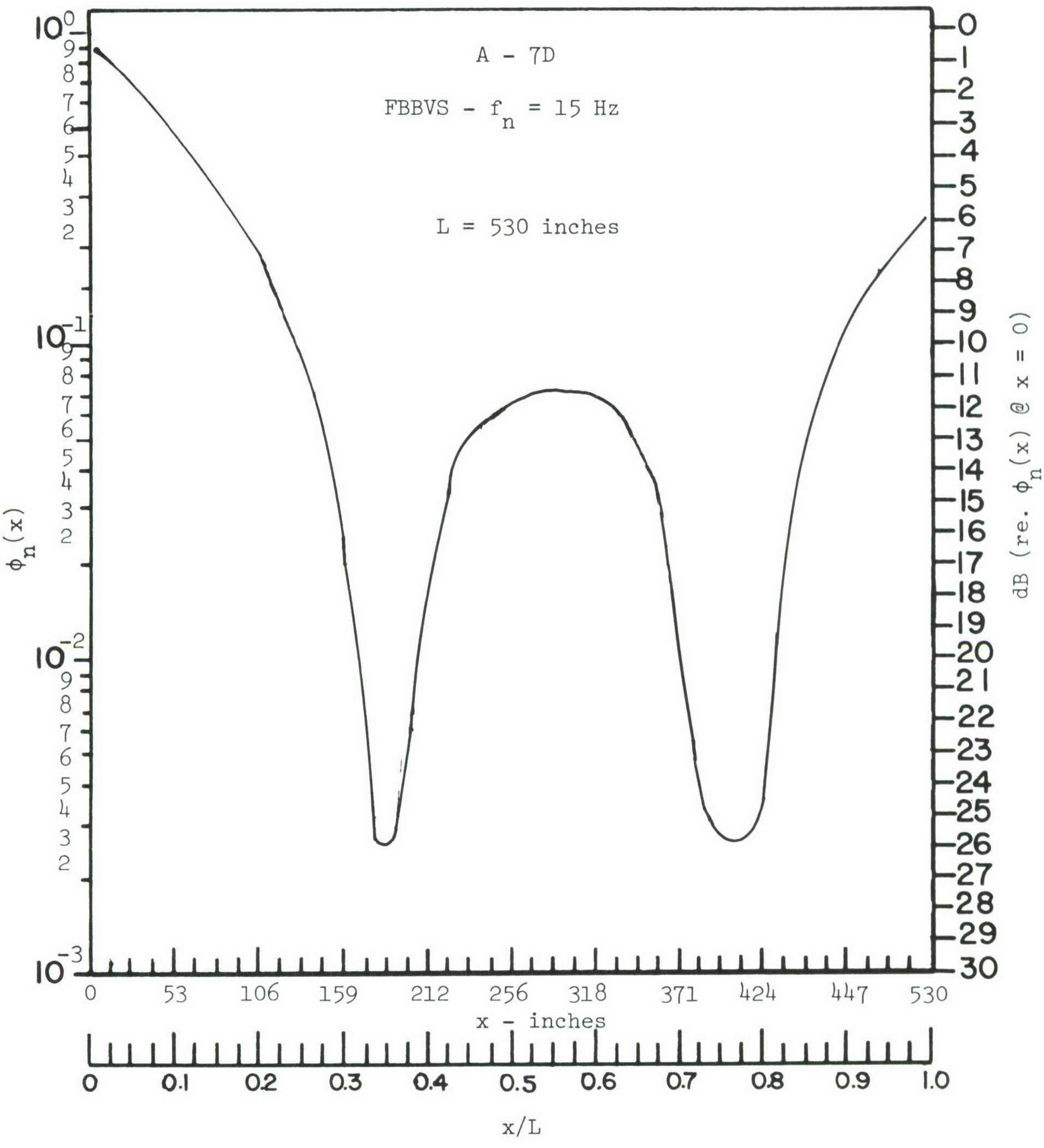


Figure B-12. Mode Shape (FBBVS) of the A-7D

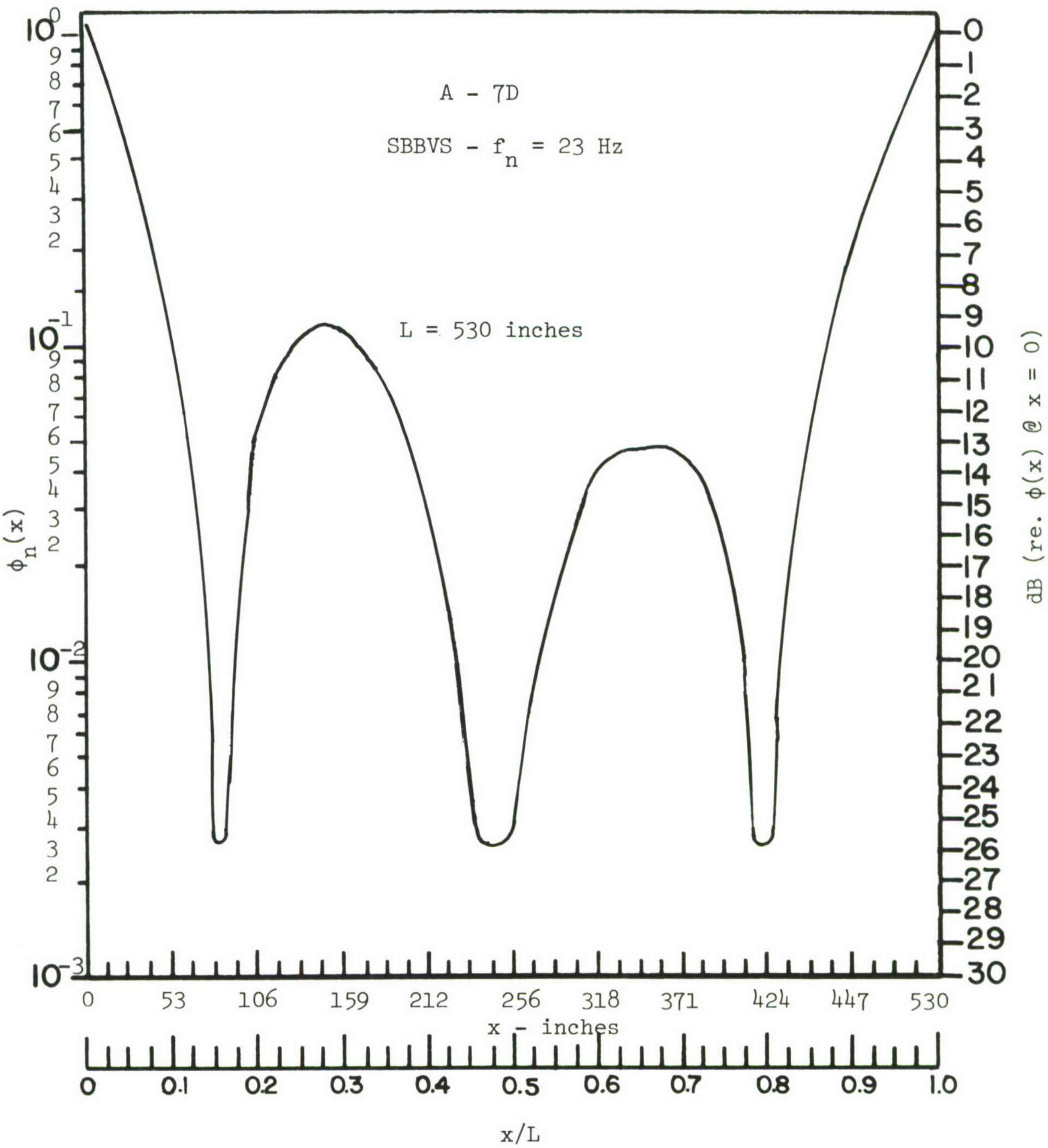
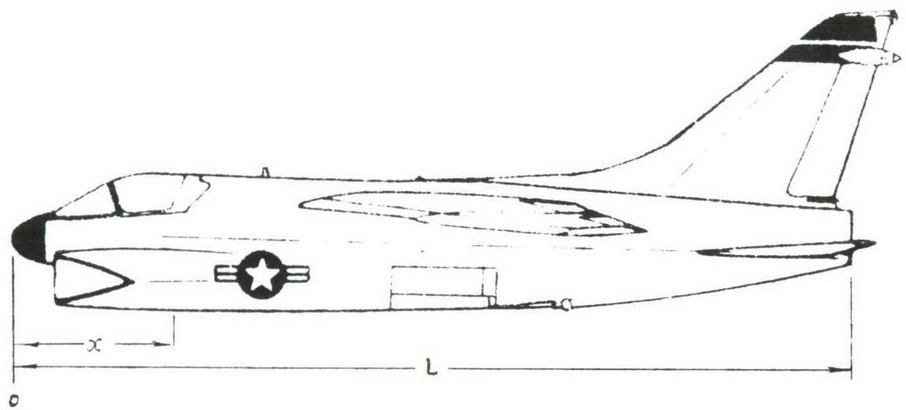


Figure B-13. Mode Shape (SBBVS) of the A-7D



Note: x=0 is equivalent to F.S. = 182 inches

Figure B-14. A-7D Aircraft Showing the x and L Parameters

APPENDIX C

TRANSFER FUNCTIONS -- LOW, MEDIUM, AND HIGH FREQUENCY

The following comments offer supplementary information to that contained in the parameter blocks of the three transfer functions. Most of the topics discussed have to do with operations that are either stored or computationally integrated into the computer program format.

1.0 Low Frequency Transfer Function, L(f)

Note that when the second mode is specified the first bending mode transfer function changes as follows: x' becomes 0.7, β' is changed to 0.23 and f_o assumes $1.54f_n$. The second bending mode transfer function $L_2(f)_M$ assumes the following parameters:

$f_o = f_{2n}/1.8$	$f_{o'} = 1.8\ f_{2n}$
$\beta = 0.2$	$\beta' = 0.2$
$x = 1.8$	$x' = 0.555$
$\alpha = 1.0$	$\alpha' = 1.8$

2.0 Medium Frequency Transfer Function, M(f)

The maximum value of M(f), which is $M_m(f)$, is reduced by $\Delta M_m(f)$ as R_s approaches the skin; that is, as R_s approaches zero. This feature, stored in the program, reflects the fact that as the equipment location moves outwardly toward the region near the skin the medium frequency vibration content begins to drop out.

Some fighter aircraft feature large internal panels, the nose avionics bay of the F-111 for example; and to allow for this spectral downshift, L(f) is translated down frequency by approximately 50 Hz.

3.0 High Frequency Transfer Function, H(f)

Figure C-3(b), among other things, shows that, contrary to the behavior of $M_m(f)$, $H_m(f)$ increases as the aircraft skin is approached.

4.0 Special Parametric Relationships

The first and second bending modes exhibit a peaked characteristic at their mode frequencies. Whenever this happens, that is, whenever the low and high frequency rolloff segment of the flex function peak at the same frequency, say f_n, then f_o and f_o' may be defined in terms of f_n. This statement is best demonstrated by use of the following sylloge.

Always, $xf_o = f_x$ and $x'f_{o'} = f_{x'}$

where: f_x = the frequency at x

and: $f_{x'}$ = the frequency at x′

Thus, $x = f_x/f_o$ and $x' = f_{x'}/f_{o'}$

Now, for the peaking case in which $f_x = f_n = f_{x'}$, it follows that

$$xf_o = f_n = x'f_o,$$

And so, $f_o = f_n/x$ and $f_o' = f_n/x'$

As observed earlier, the peaking form of the flex function appears for bending mode applications; it also appears in the description of the medium frequency transfer function, M(f) -- only to reappear once again as the limiting case for H_m (f) when R_s and W_E are assigned large values.

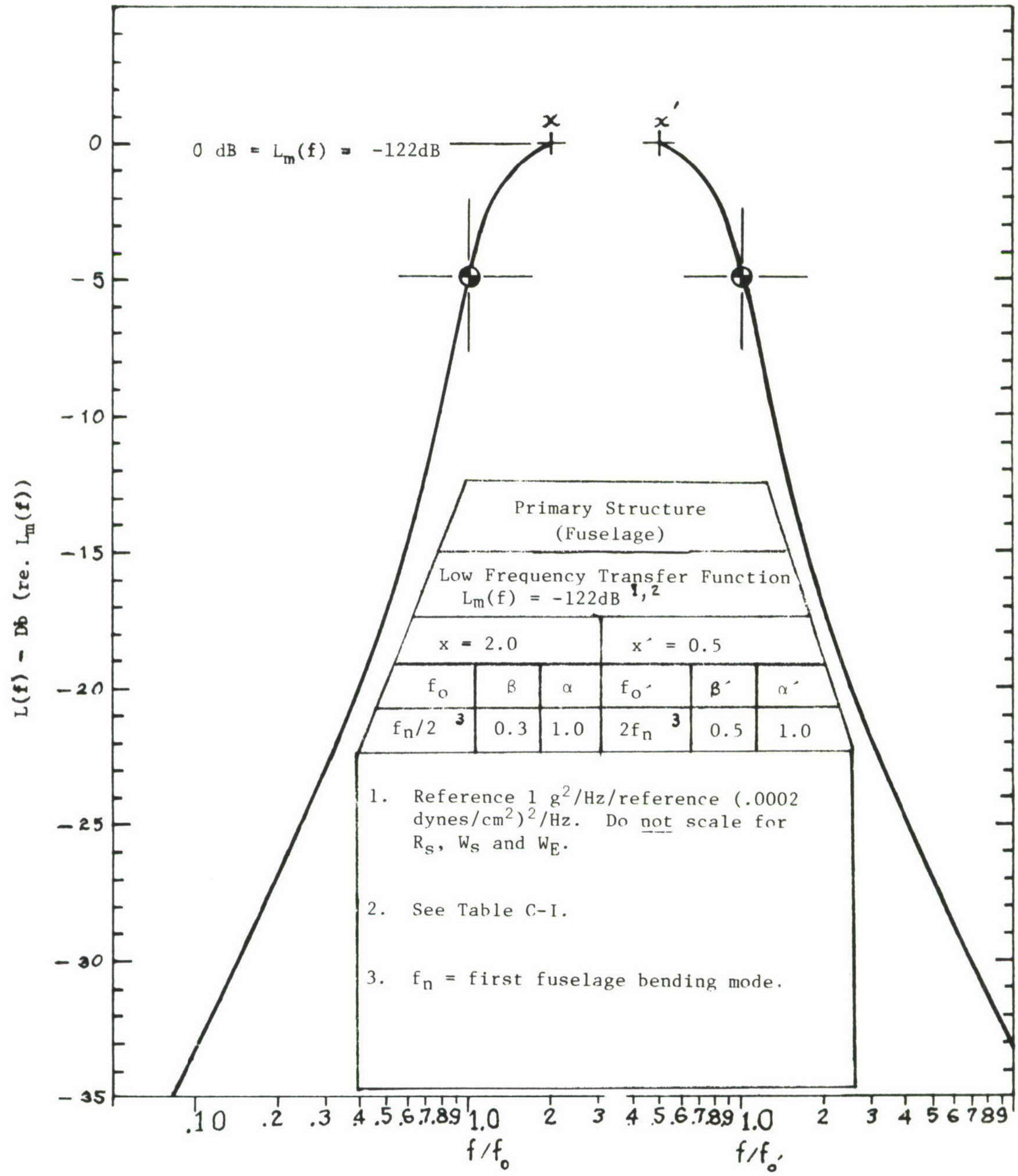


Figure C-1. Low Frequency Transfer Function, L(f), for Fighter Aircraft Fuselage

TABLE C-1

PARAMETRIC VALUES FOR FIRST AND SECOND BENDING MODES*
(AIRCRAFT FUSELAGE)

First Bending Mode

Aircraft Type	$L_m(f)_1$ (dB)	f_n (Hz)
RF-4C	-122	14.3
F-16	-131	12.9
F-111	-134	8.5
A-7D	-129	15.2
F-15	-127	8.5

Second Bending Mode

Aircraft Type	$L_m(f)_2$ (dB)	f_{2n} (Hz)
RF-4C	-129	19.0
F-16	-133	32.5
F-111	----	----
A-7D	-140	23.0
F-15	-131	27.8

*See Appendix B

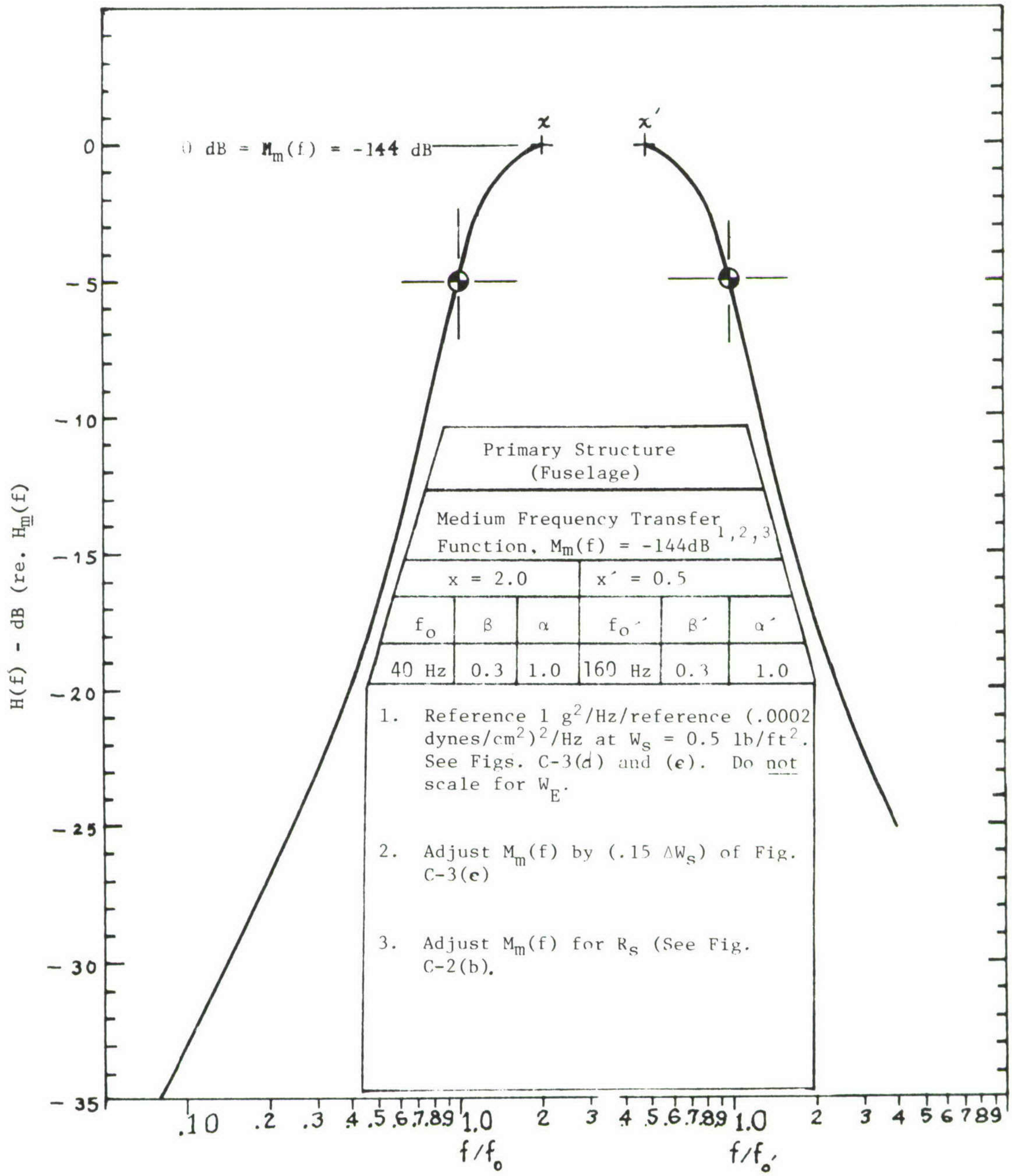


Figure C-2a. Medium Frequency Transfer Function, M(f), for Fighter Aircraft

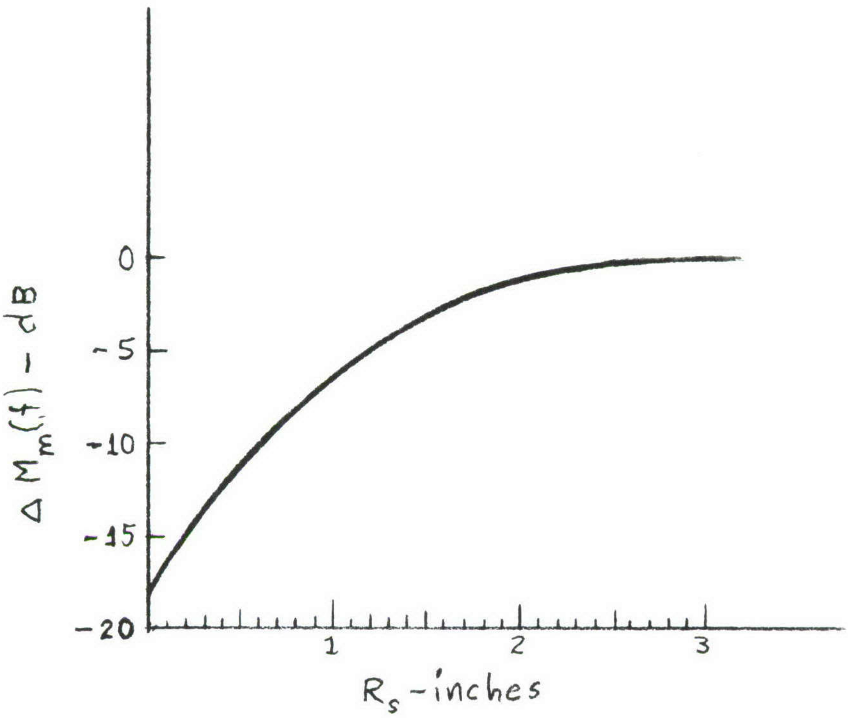
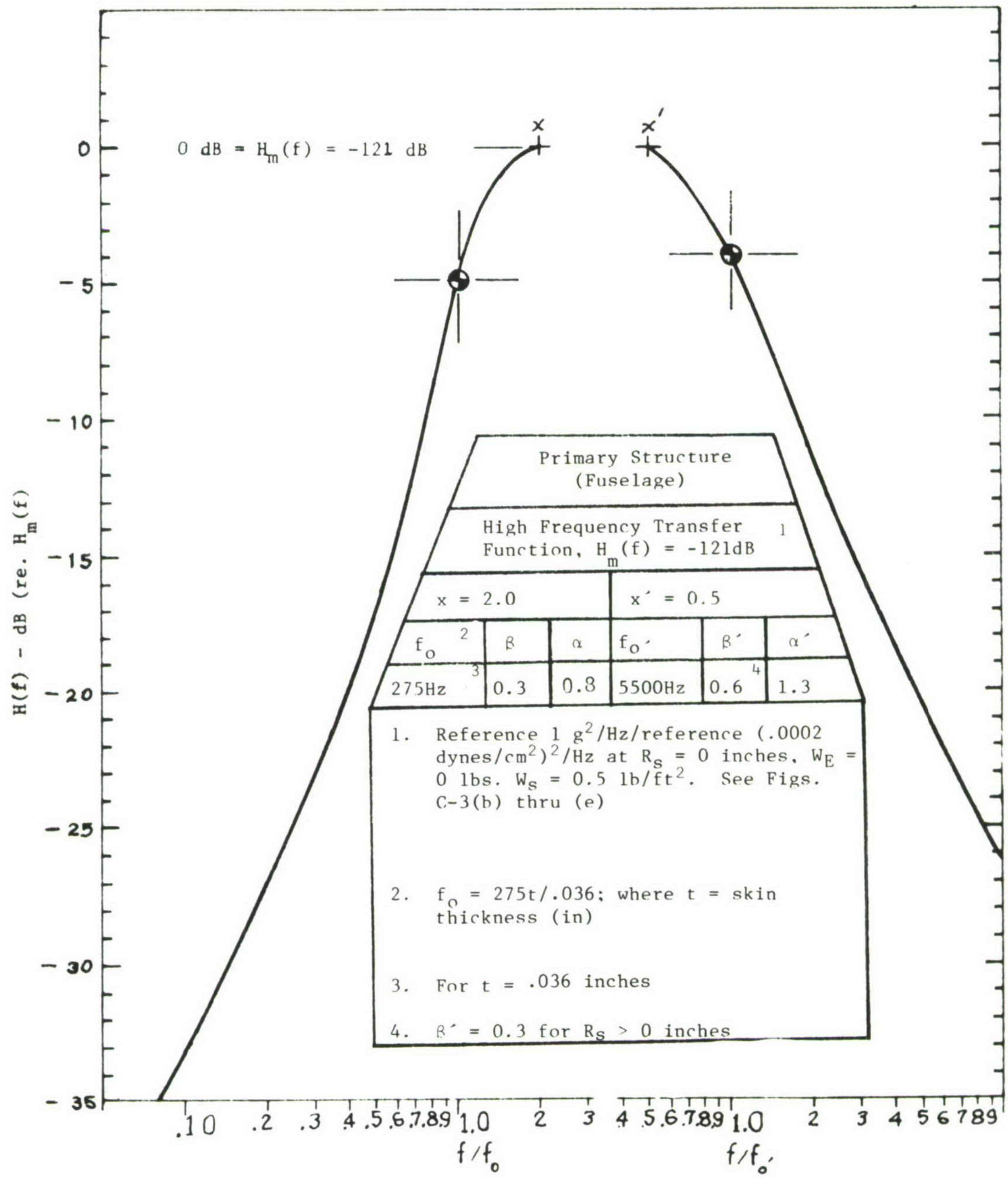


Figure C-2b. Attenuation of M_m (f) as a Function of R_s



Primary Structure (Fuselage)					
High Frequency Transfer Function, $H_m(f)$ = -121dB [1]					
x = 2.0			x′ = 0.5		
f_o [2]	β	α	f_o′	β′	α′
275Hz [3]	0.3	0.8	5500Hz	0.6 [4]	1.3

1. Reference 1 g^2/Hz/reference (.0002 dynes/cm^2)^2/Hz at R_S = 0 inches, W_E = 0 lbs. W_S = 0.5 lb/ft^2. See Figs. C-3(b) thru (e)
2. f_o = 275t/.036; where t = skin thickness (in)
3. For t = .036 inches
4. β′ = 0.3 for R_S > 0 inches

Figure C-3a. High Frequency Transfer Function, H(f), for Fighter Aircraft

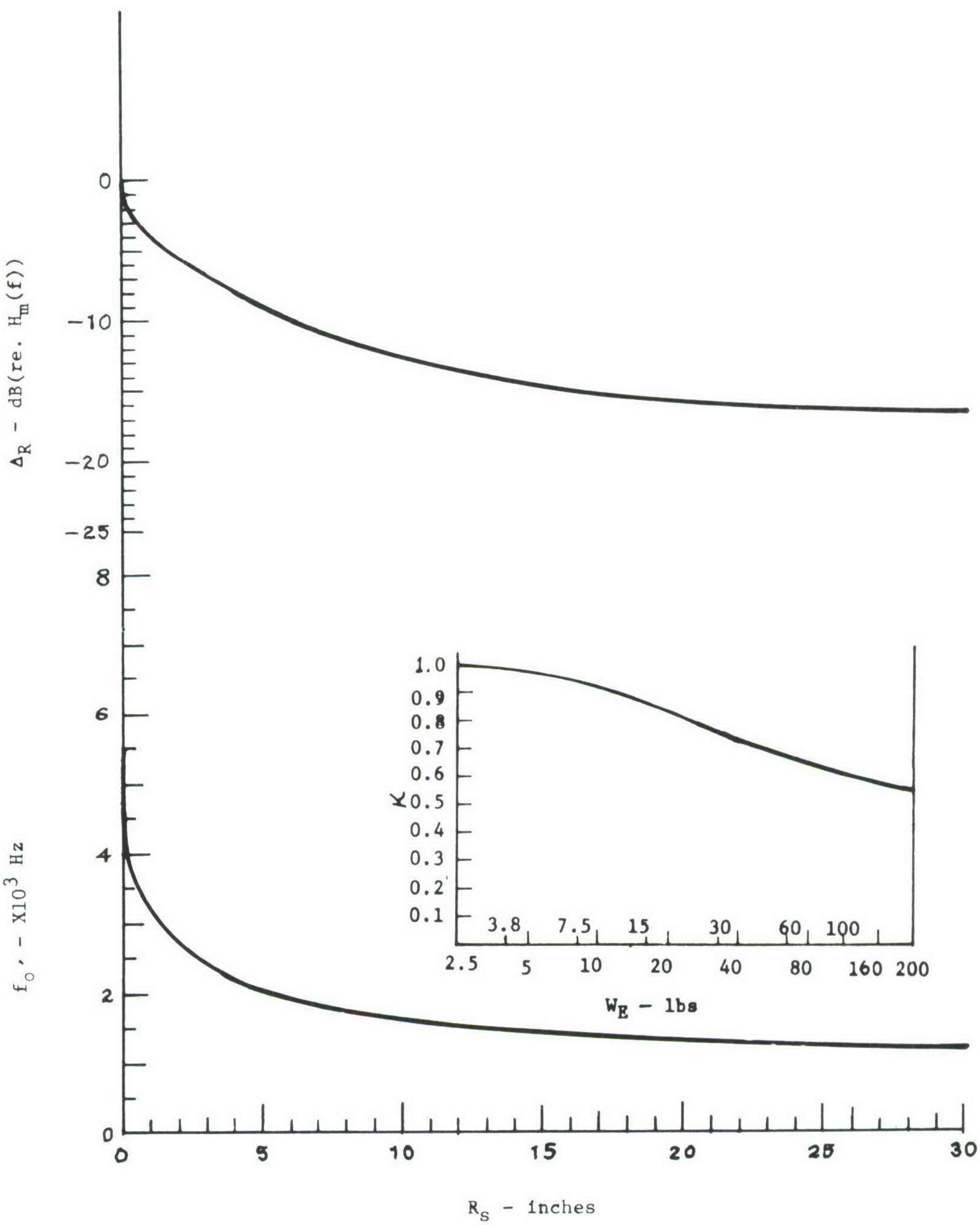


Figure C-3b. Frequency and Amplitude Attenuation of H_m (f) as a Function of R_S

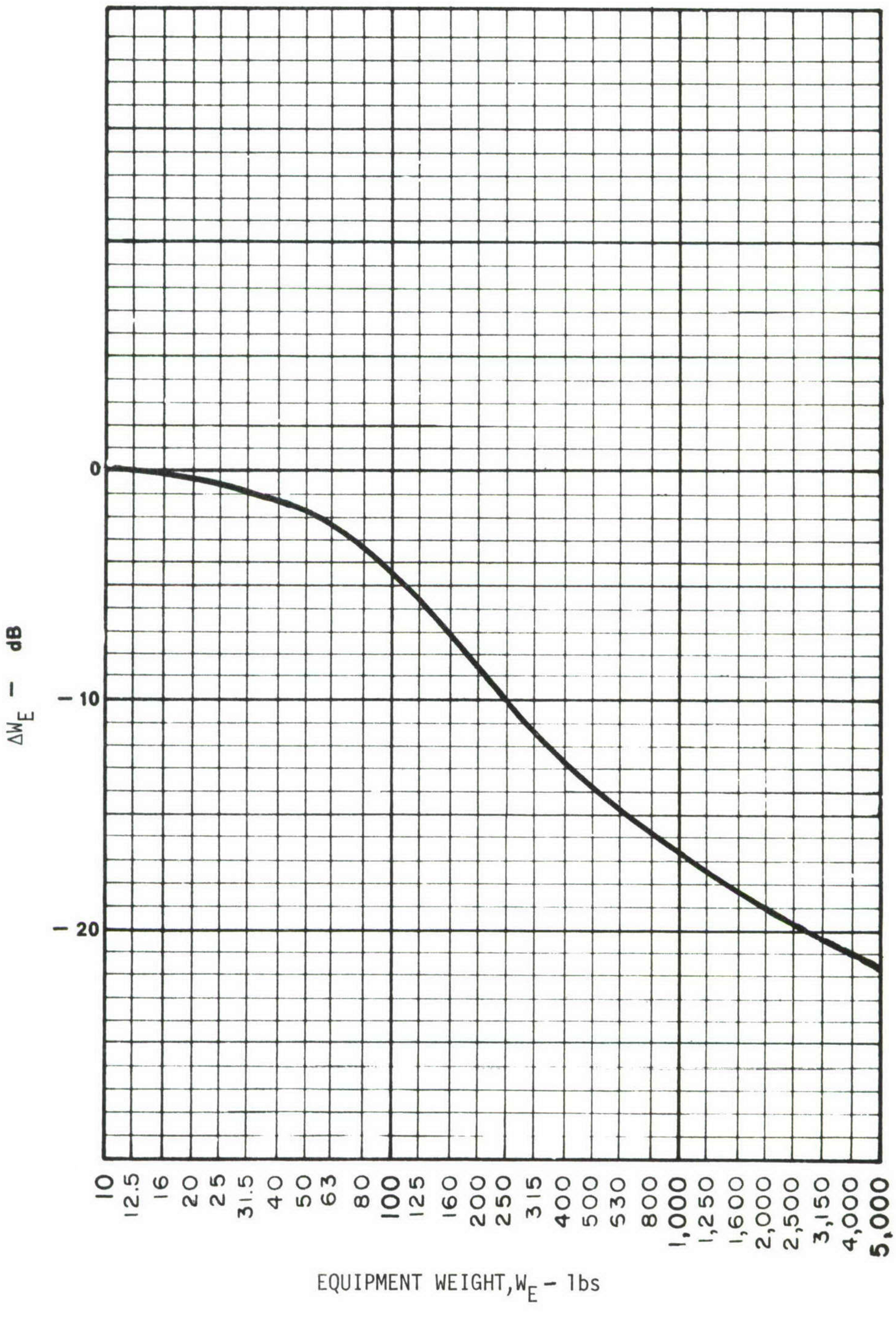


Figure C-3c. Attenuation of $H_m(f)$ as a Function of Equipment Weight

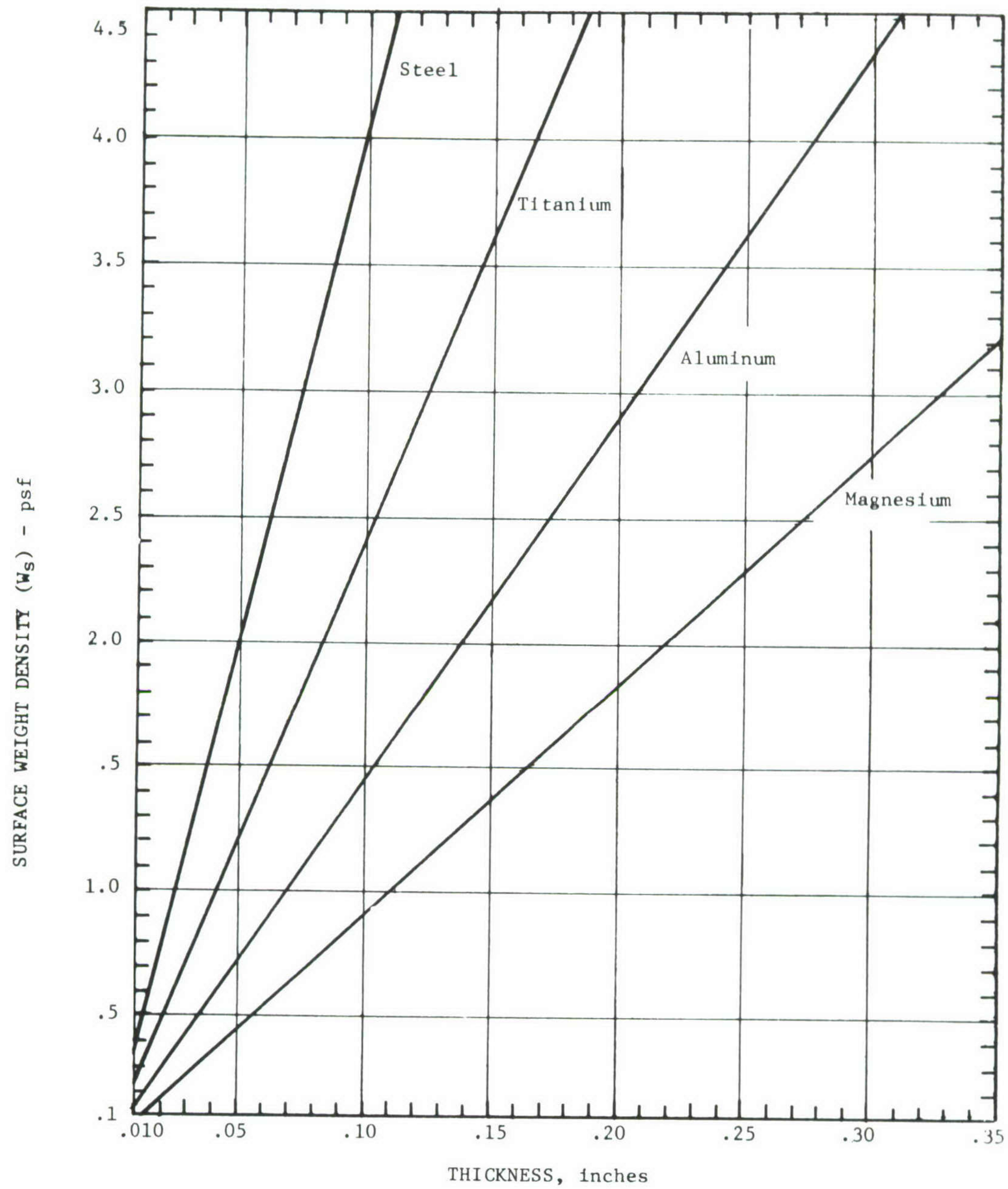


Figure C-3d. Surface Weight Density for Aircraft Materials and Their Thicknesses

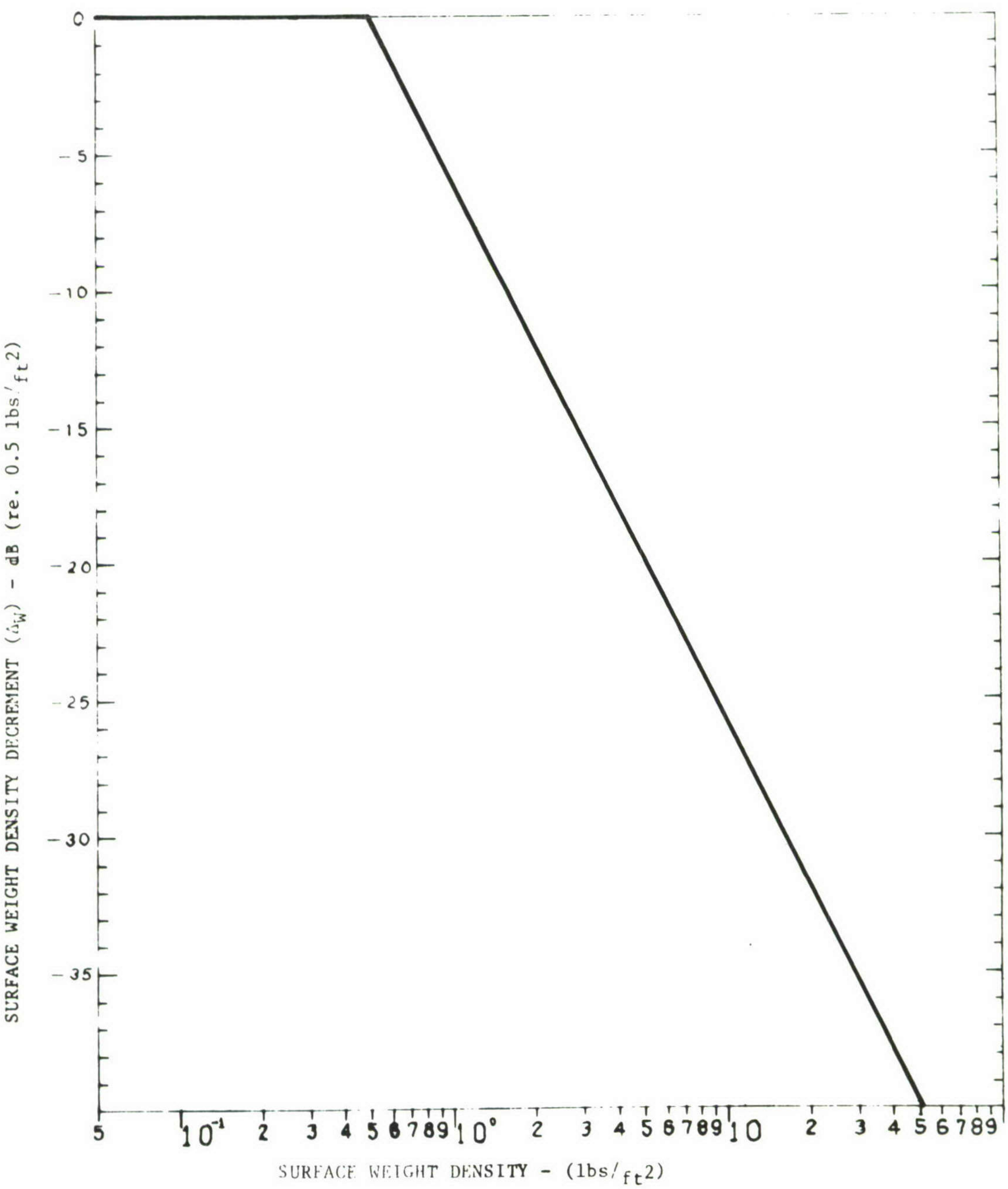


Figure C-3e. Attenuation of $H_m(f)$ as a Function Surface Weight Density

APPENDIX D

SPECIAL FUNCTIONS

The purpose of the special functions is to provide an appropriate function which, after having operated on P(f), results in a specific input to the transfer function elements that, in turn, predict the vibration input spectra of aircraft equipments during flight conditions that deviate from the smooth, straight and level norm. Such flight phases as buffet turn, pullups, takeoff, landing, rough air turbulence, proximity to open speed brakes (flaps), refueling doors, chin effects, including open weapons bay cavitations -- all of these conditions invoke special functions, a limited number of which are described in Figures D-2 through D-4.

1.0 Available Functions

Four functions presently incorporated into this Appendix describe the following flight phases: buffet turn (BT), takeoff (T), landing (L), low frequency atmospheric turbulence (TB). Several of the special functions involve a series of distance parameters listed in Table D-1 and illustrated in Figure D-1.

1.1 Buffet Turn

This excitation results from tight, high g turns that appear only infrequently in the fighter mission profile. The resultant levels, however, are sufficiently severe (see Figure D-2) to warrant inclusion. Note that excitations arising from pullups, speed brakes, flaps, landing gears, and open refueling doors belong

TABLE D-I

Downstream Distance (x)* for Special Functions $S_{BT}(f)$, $S_T(f)$ and $S_L(f)$

Aircraft	x_{BT}	x_T	x_L
F-4	32.3	35.3	35.3
F-111	38.1	47.7	47.7
F-16	27.1	29.5	29.5
F-5	27.7	28.3	28.3
A-7D	20.5	25.4	25.4
F-15	39.1	40.2	40.2

*in feet

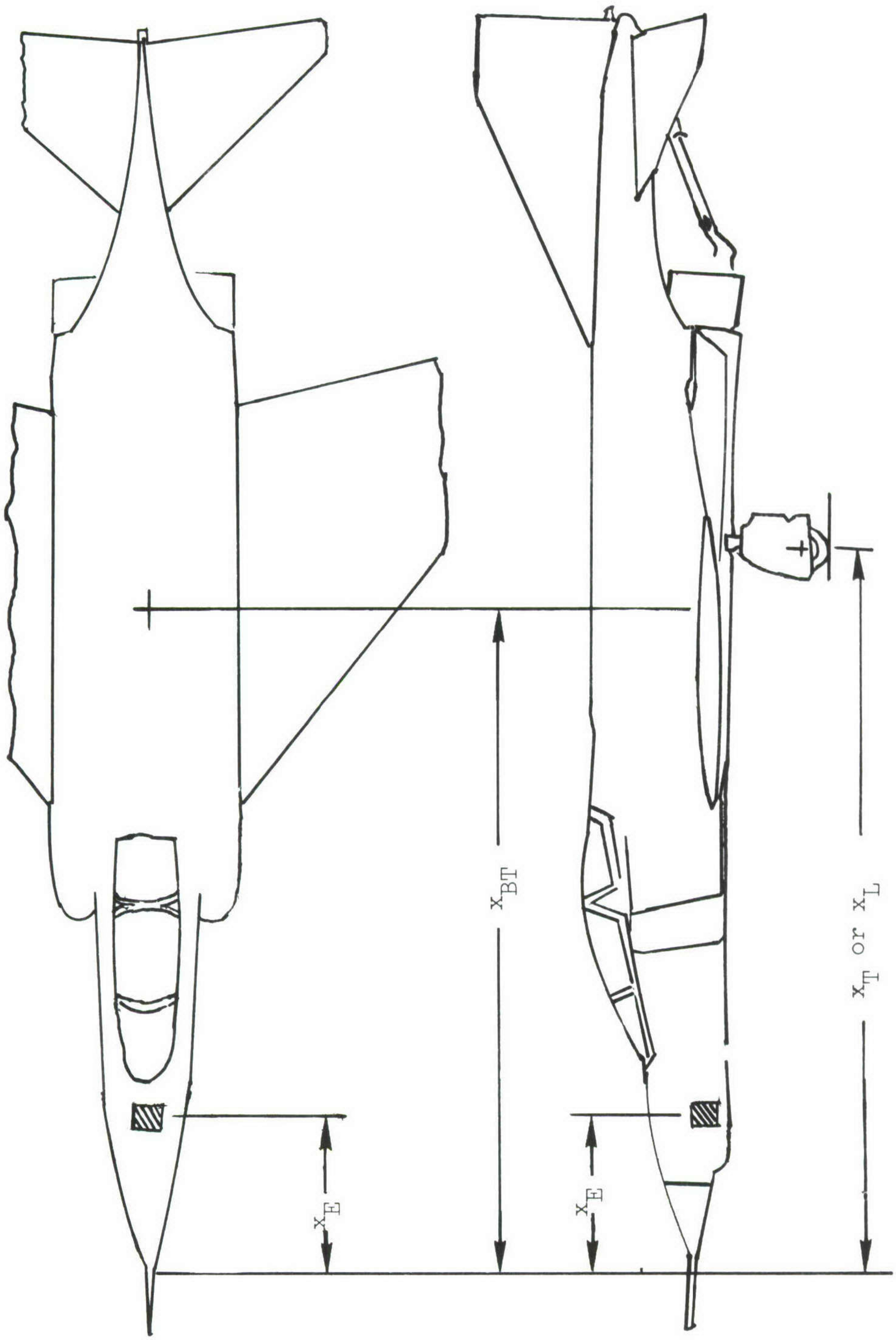


Figure D-1. Location on Aircraft of x_{BT}, x_T, x_L

in this family of special functions. They have not, as yet, been synthesized for the current computer program. The pullup phase (PU), be it noted, is, in its main characteristics, sufficiently close to that of the BT phase to allow temporary substitution.

1.2 Takeoff

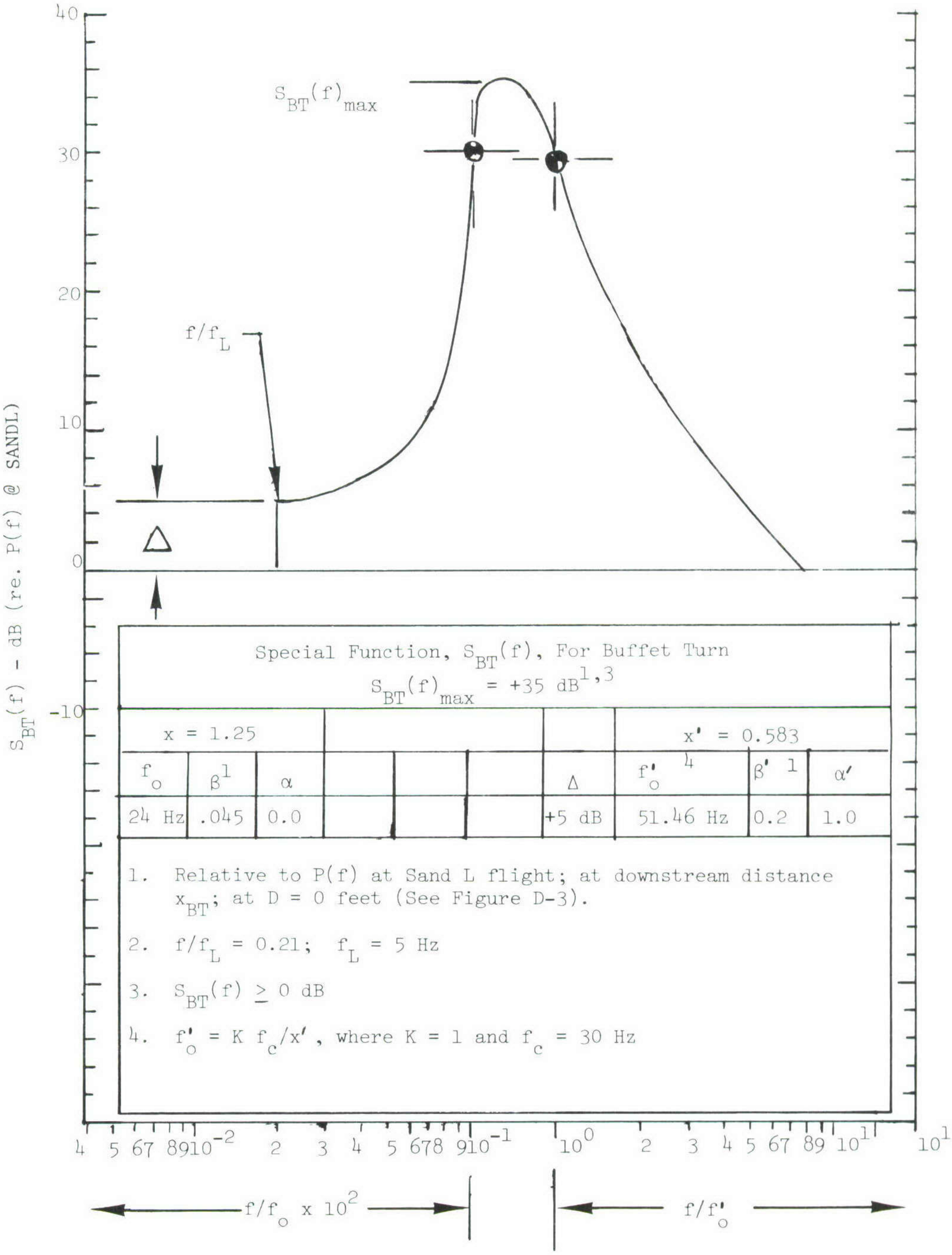
$S_T(f)$ is derived from F-4 data and is referenced to that aircraft at the straight and level flight conditions noted in Figure D-4. Although this approach may be suitable as an approximation for most predicted results, it is prudent to add $10 \log_{10} T_{max}/5x10^4$ to the high frequency portion (see H(f)) of the final predicted spectrum when the aircraft features engines with a maximum thrust, T_{max}, appreciably greater than 50,000 lbs. Note that this last provision has not yet been entered into the computer program.

1.3 Landing

$S_L(f)$ emphasizes the excitation of the fuselage second bending mode (vertical); otherwise there is no great distinction to this flight phase.

1.4 Low Frequency Atmospheric Turbulence

This function is, in effect, added to the SANDL flight phase of the aircraft to provide emphasis in the low frequency regime. Simulation of rough air characteristics is the objective of this special function and may be used in conjunction with P(f) at any altitude and mach combination so long as the flight conditions are straight and level.



Special Function, $S_{BT}(f)$, For Buffet Turn

$S_{BT}(f)_{max} = +35$ dB[1,3]

x = 1.25							x' = 0.583		
f_o	β^1	α				Δ	f'_o [4]	β' [1]	α'
24 Hz	.045	0.0				+5 dB	51.46 Hz	0.2	1.0

1. Relative to P(f) at Sand L flight; at downstream distance x_{BT}; at D = 0 feet (See Figure D-3).
2. $f/f_L = 0.21$; $f_L = 5$ Hz
3. $S_{BT}(f) \geq 0$ dB
4. $f'_o = K\, f_c/x'$, where K = 1 and $f_c = 30$ Hz

Figure D-2. Special Function, $S_{BT}(f)$, for Buffet Turn

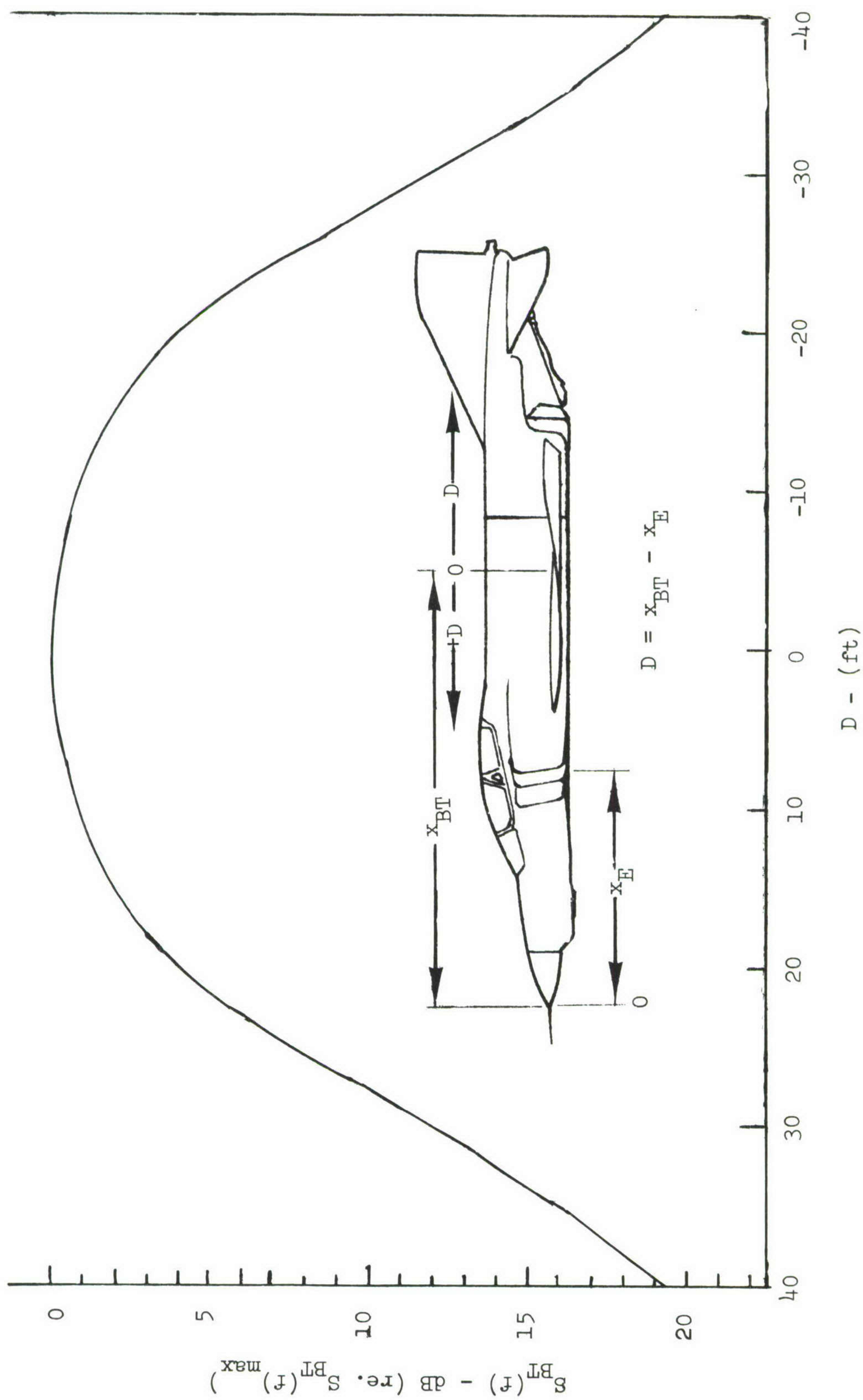


Figure D-3. Location on Aircraft of D Parameter

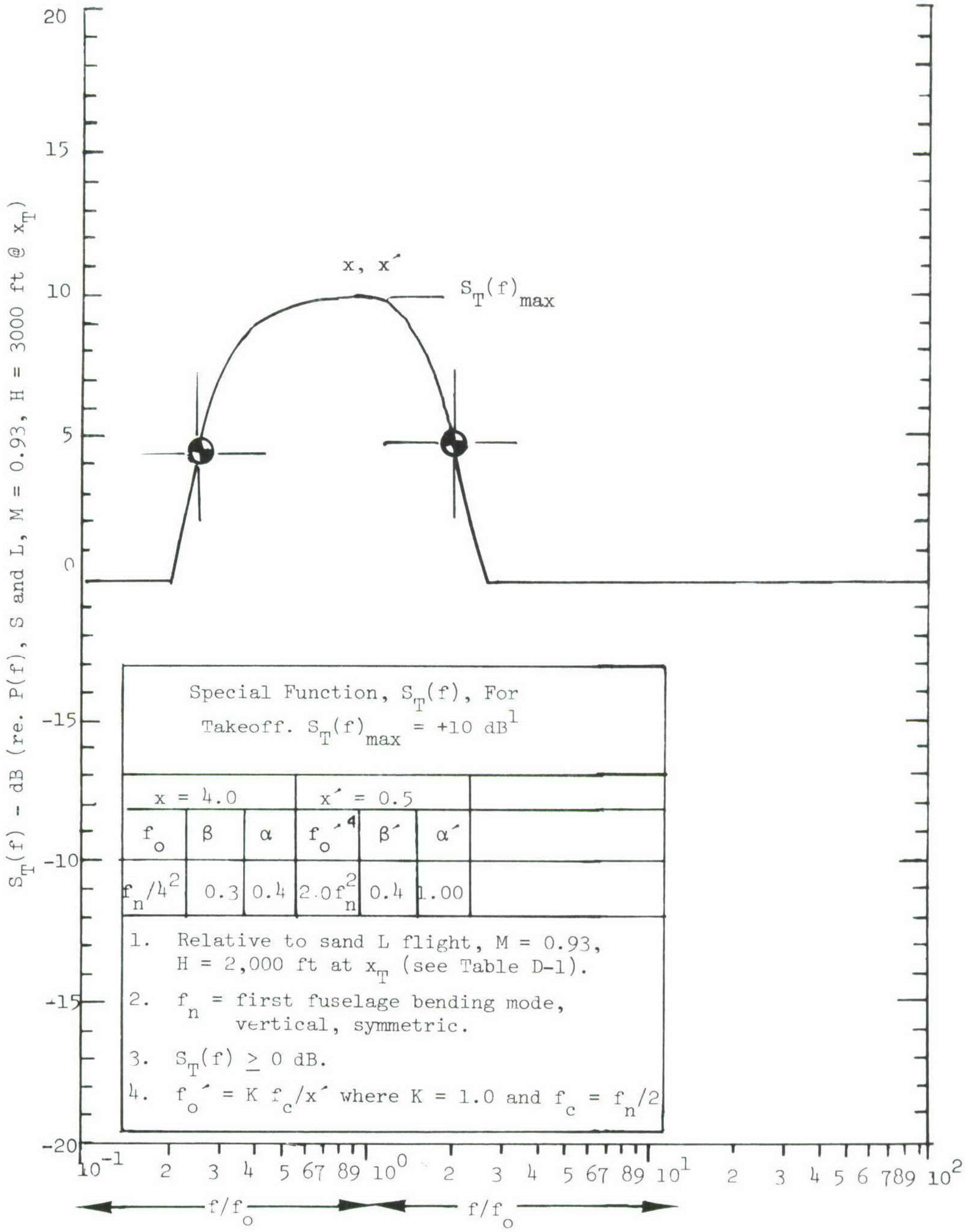
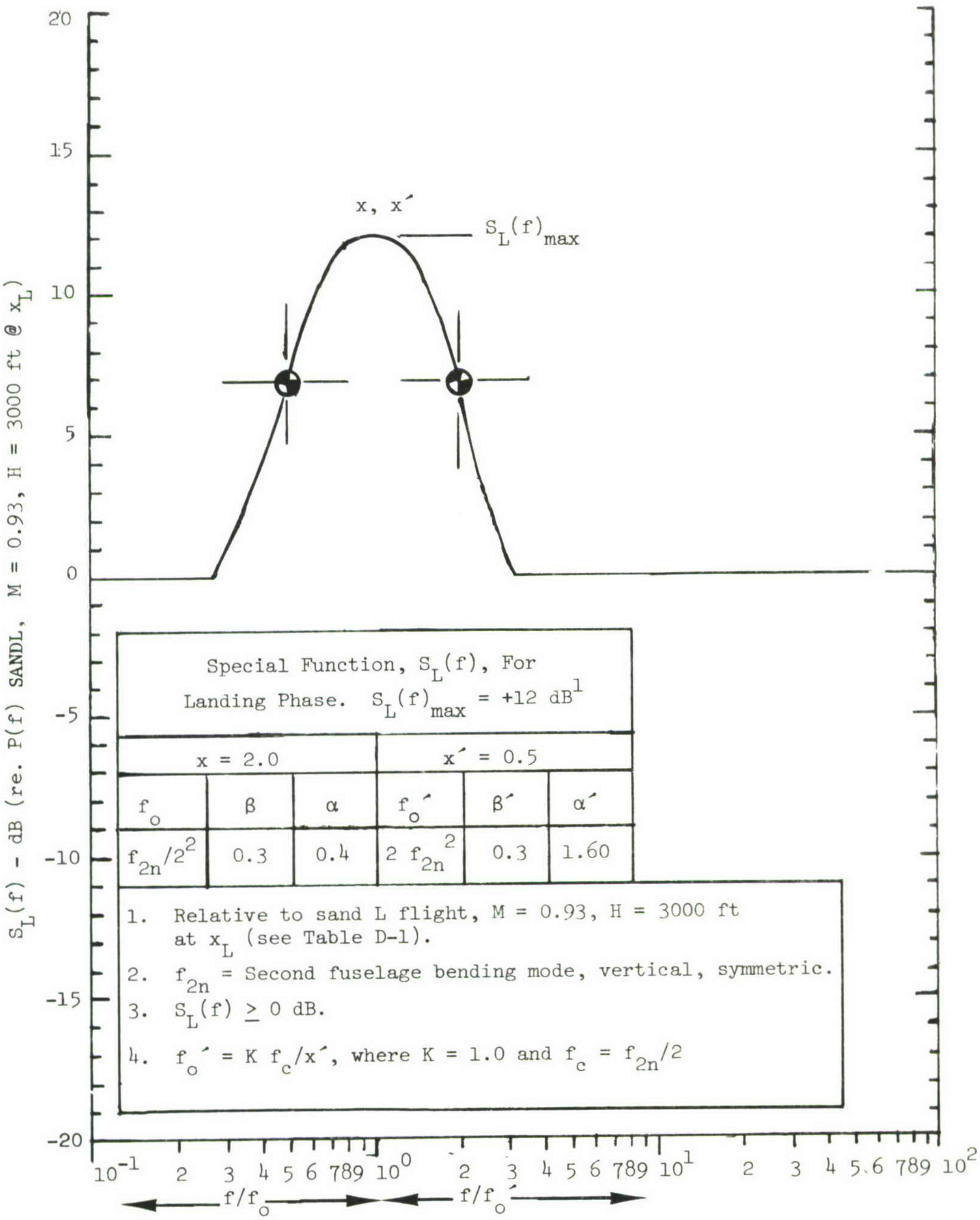


Figure D-4. Special Function, $S_T(f)$, for Takeoff



Special Function, $S_L(f)$, For Landing Phase. $S_L(f)_{max}$ = +12 dB[1]

x = 2.0			x´ = 0.5		
f_o	β	α	f_o'	β'	α'
$f_{2n}/2^2$	0.3	0.4	$2 f_{2n}^{2}$	0.3	1.60

1. Relative to sand L flight, M = 0.93, H = 3000 ft at x_L (see Table D-1).
2. f_{2n} = Second fuselage bending mode, vertical, symmetric.
3. $S_L(f) \geq 0$ dB.
4. $f_o' = K f_c/x'$, where K = 1.0 and $f_c = f_{2n}/2$

Figure D-5. Special Function, $S_L(f)$, for Landing

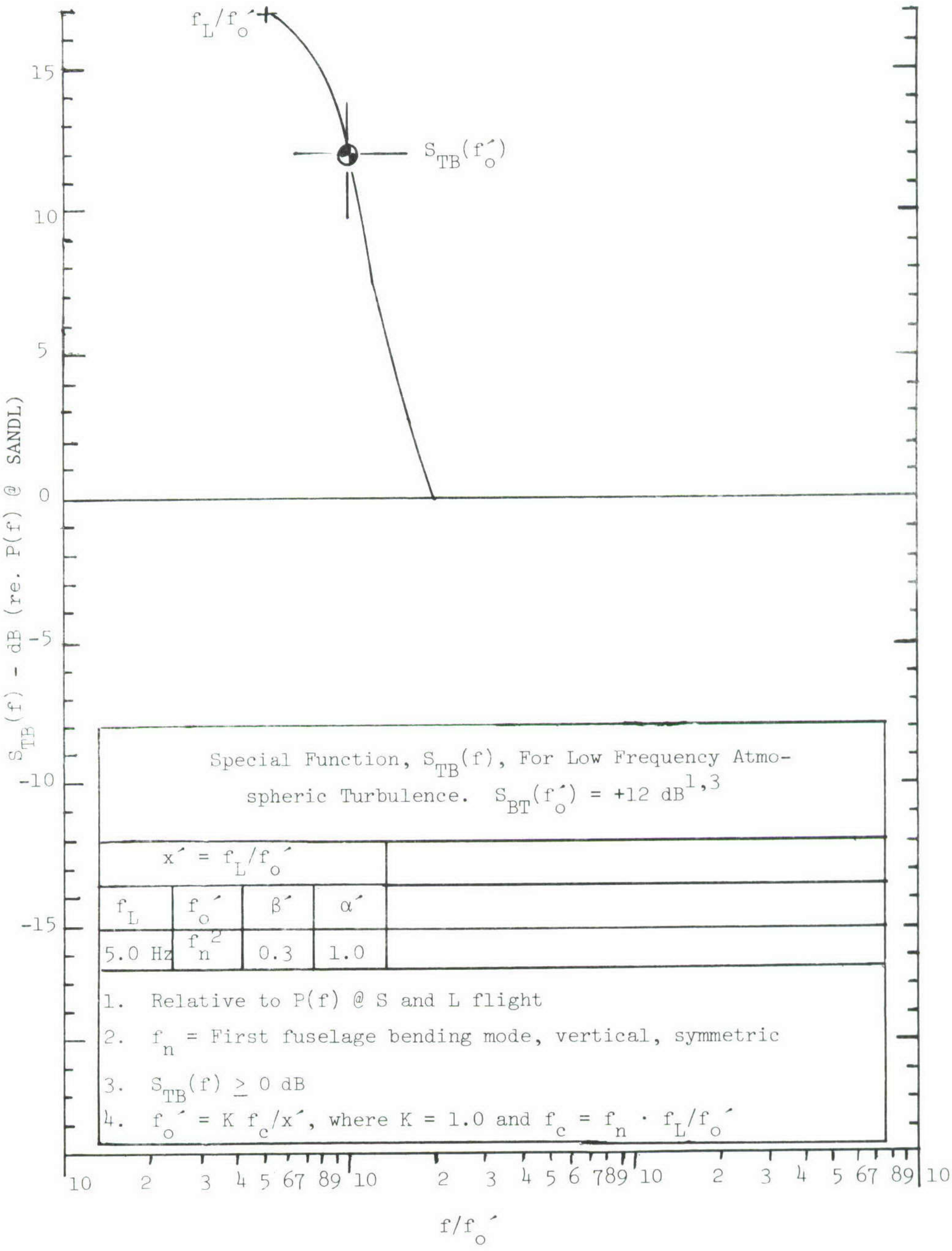


Figure D-6. Special Function, $S_{TB}(f)$, for Low Frequency Atmospheric Turbulence

APPENDIX E

EQUIPMENT MOUNTING CATEGORIES

1.0 Category Selection

Table E-1 provides a number of equipment mounting configurations that, with the possible exceptions of categories III and IV(a), represent equipment mounting methods commonly encountered in fighter aircraft. By referring to the simplified drawings of the table, the user may choose which of the configurations most closely agrees with the user's particular equipment mounting situation. Having selected a category, the user has immediate reference to the adjacent remarks column which identifies and locates the transfer function corresponding to the selected category. All such transfer functions are, of course, stored in the program card file and are automatically selected when the user identifies the category during the input steps detailed in Section III.

1.1 I(b), A Special Case

Note that Category I(b) is simply the high frequency transfer function, H(f), and represents the only case when $H_m(f)$ is corrected for the equipment mass loading, W_E (see Appendix C). Mass loading corrections for the other categories are integrated into their respective transfer functions, Y(f); this can be seen by referring to the associated graphs of the transfer function curves (Figures E-1 through E-5).

1.2 Spatial Adjustment for R(f)

Predicted response magnitudes of the secondary structure are based upon structural transfer functions, whose maximum values, $Y_m(f)$, are taken to be at the first bending antinodal point of the shelves, racks, or instrument panels (Figures E-5 and E-6). Thus R(f) represents the maximum expected response of the structure and this is usually at the midspace point. For many fighter aircraft configurations, the equipment mounting points are located rather close to the end constraints of the secondary structure. From the equipment response viewpoint, this situation represents the case where R(f) tends to approach G(f) and thereby induces the following decision criteria (not yet entered into the computer program); a criteria which allows the user a choice of responses, R(f) or G(f).

If $\varepsilon \leq L/4$
let $R(f) = G(f)$ (see Figure E-5)

If the above condition is obtained, then the user may reject the computer output of R(f) and select G(f).

TABLE E-I

Transfer Function Categories For Equipments Mounted In Fighter Aircraft

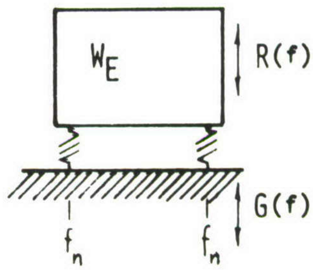
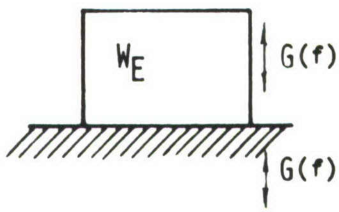
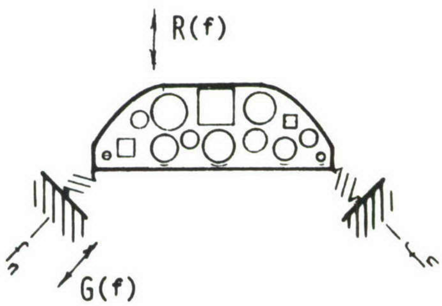
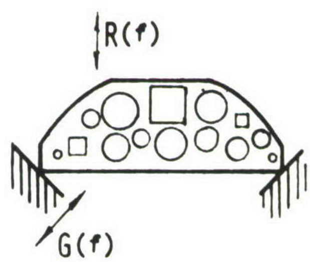
CATEGORY		REMARKS
I(a)		See Fig. E-1(a)
I(b)		See Fig. E-1(b) and Fig. C-7
II(a)		See Fig. E-2(a) and Table E-II
II(b)		See Fig. E-2(b) and Table E-II

TABLE E-I (Cont.)

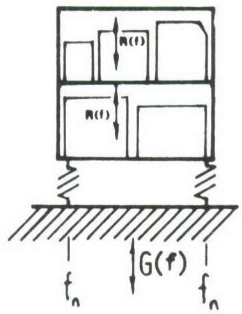
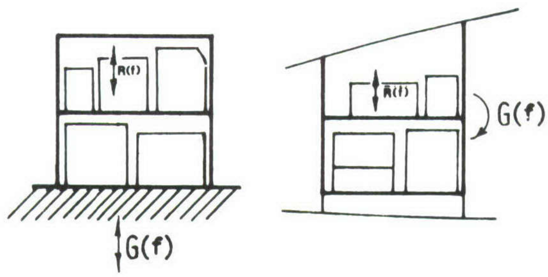
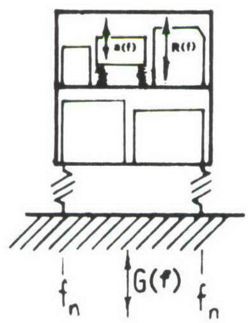
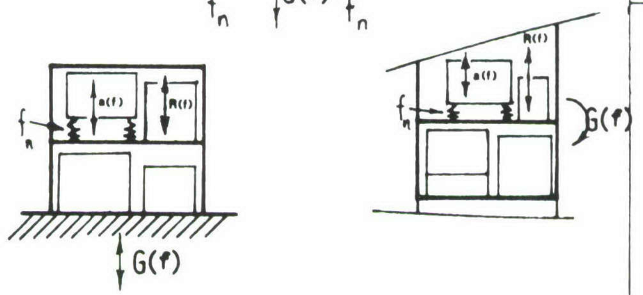
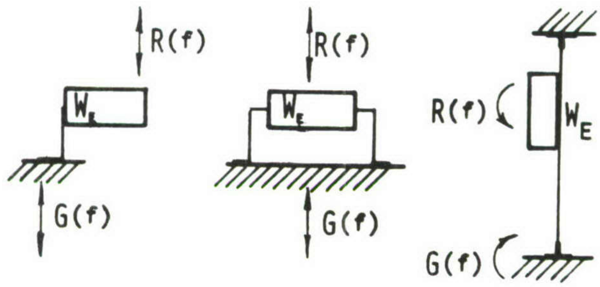
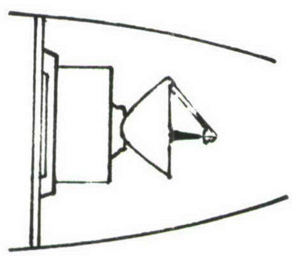
CATEGORY		REMARKS
III(a)		See Fig. E-3(a)
III(b)		See Fig. E-3(b)
IV(a)		dB wise, add Fig. E-I(a) to Fig. E-3(a)
IV(b)		dB wise, add Fig. E-1(a) to Fig. E-3(b)

TABLE E-I (Cont.)

CATEGORY		REMARKS
V		See Fig. E-5
VI		See Fig. E-7

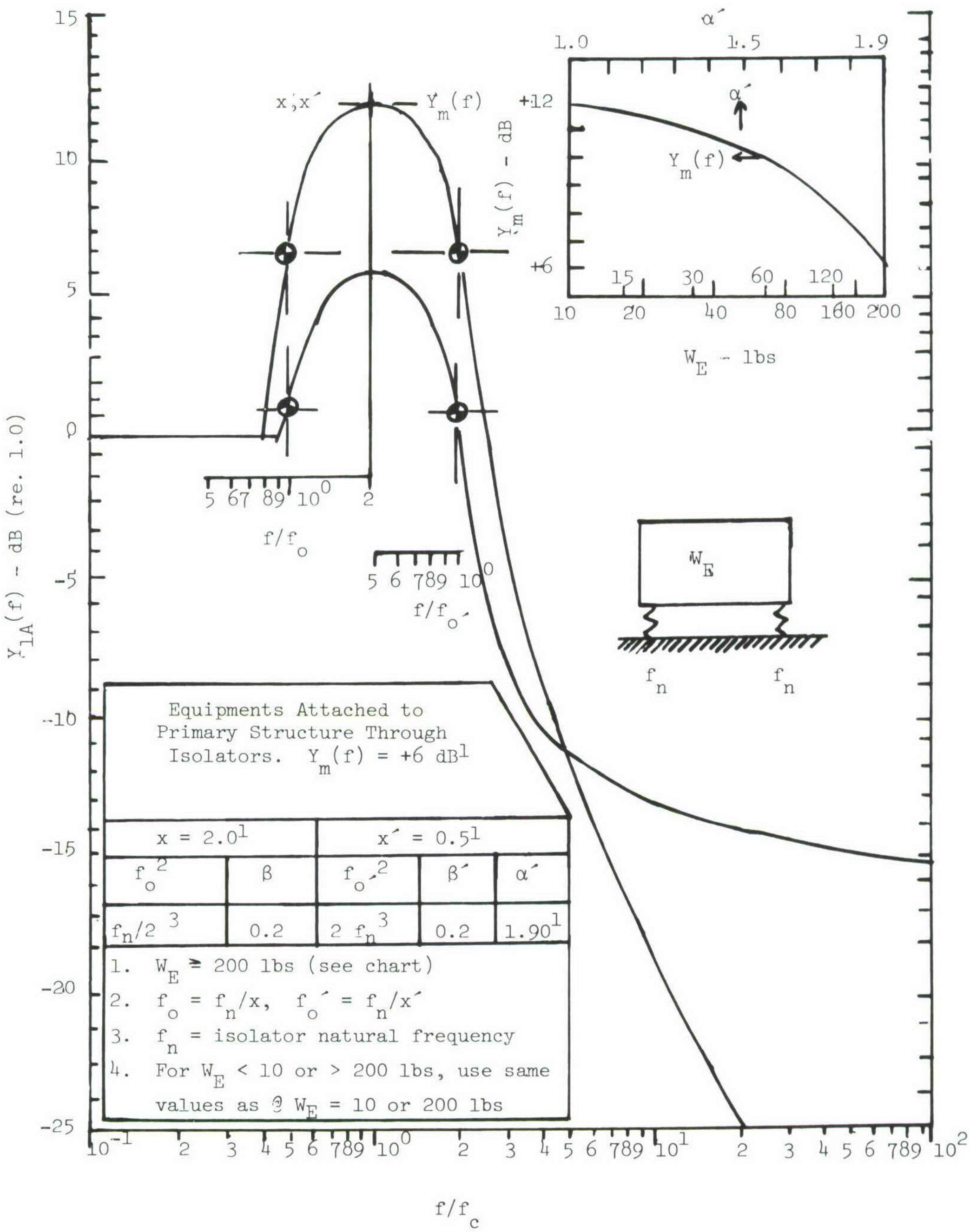


Figure E-1a. Transfer Function for Category I(a)

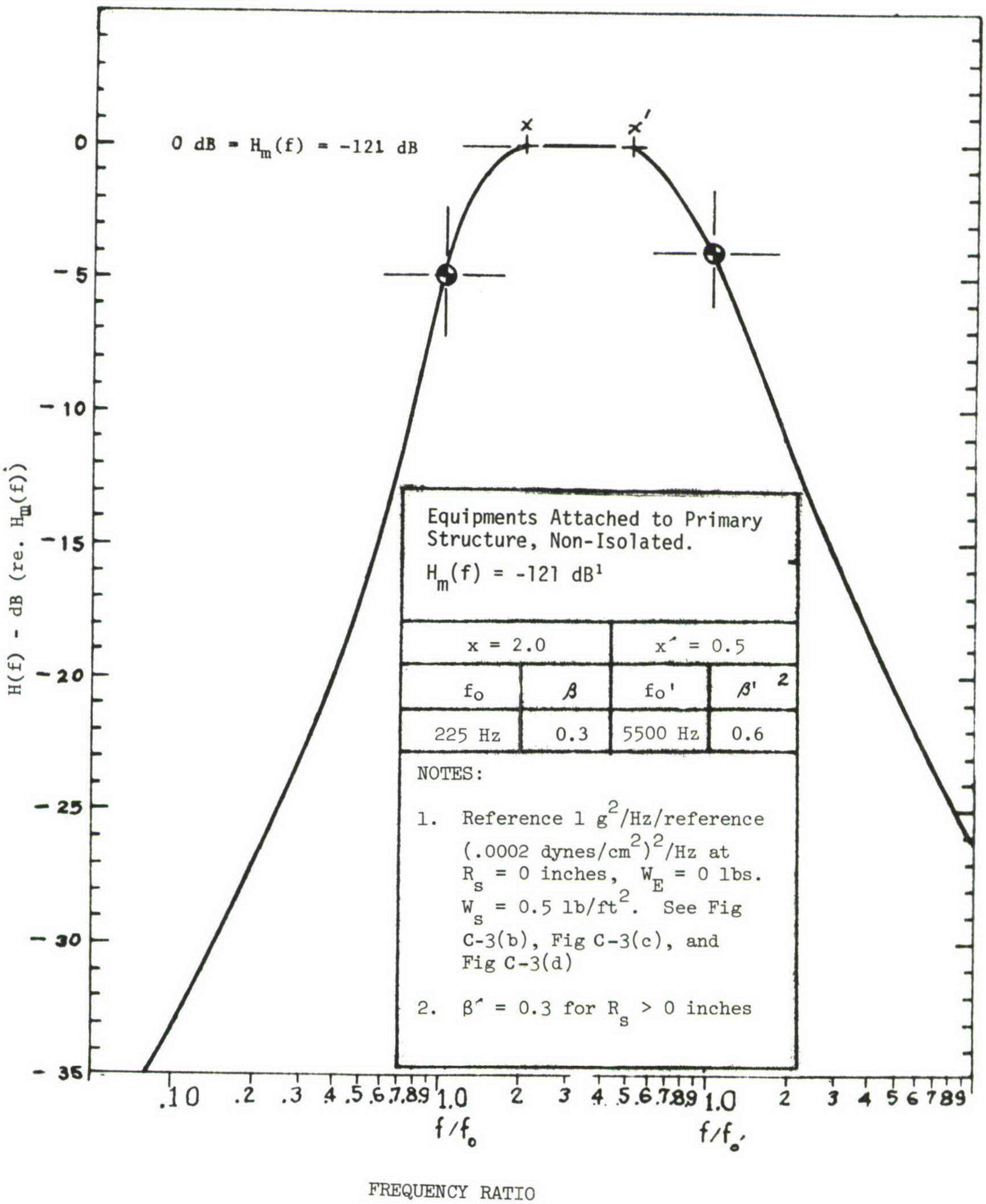
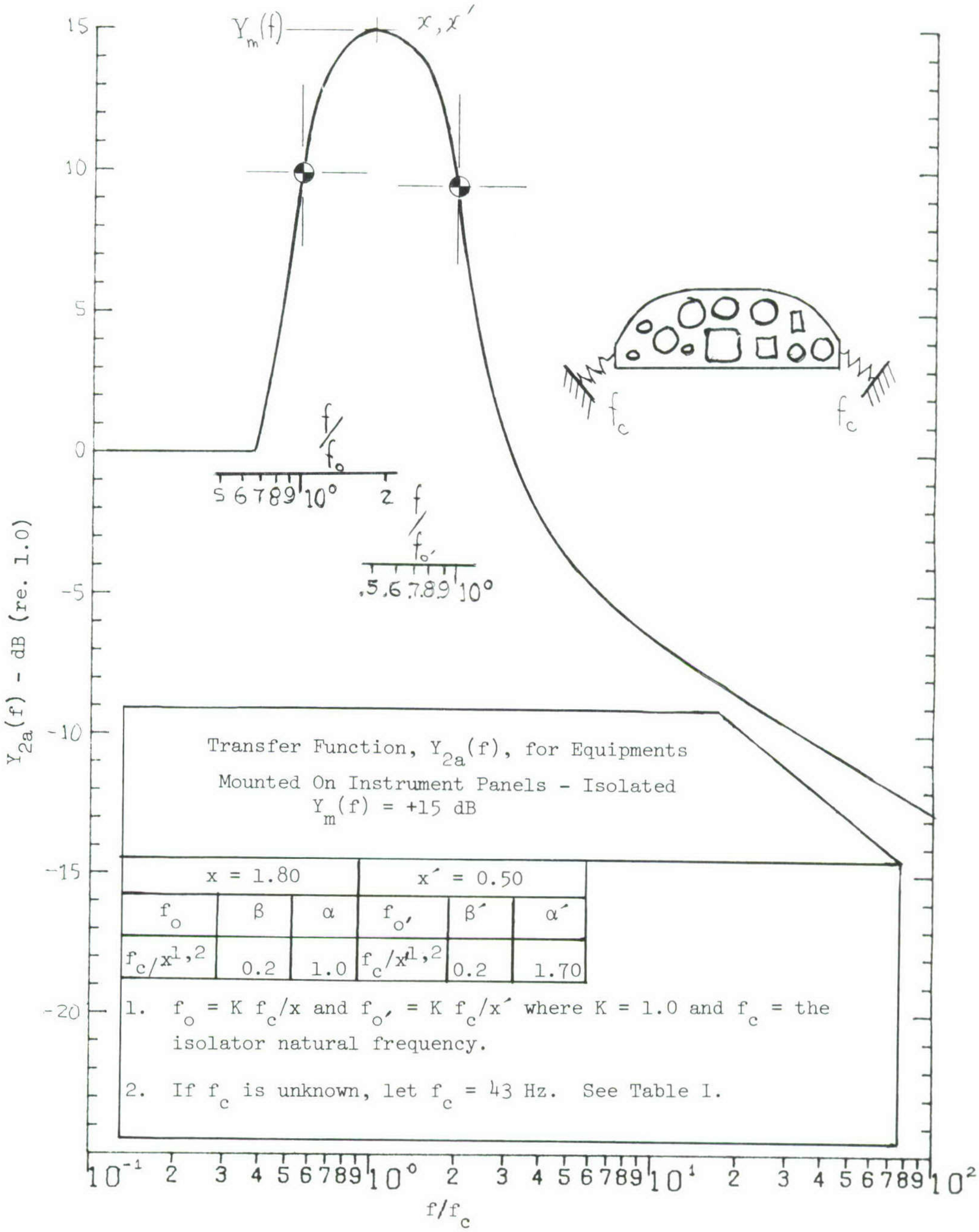


Figure E-1b. Transfer Function for Category I(b)



Transfer Function, $Y_{2a}(f)$, for Equipments Mounted On Instrument Panels - Isolated

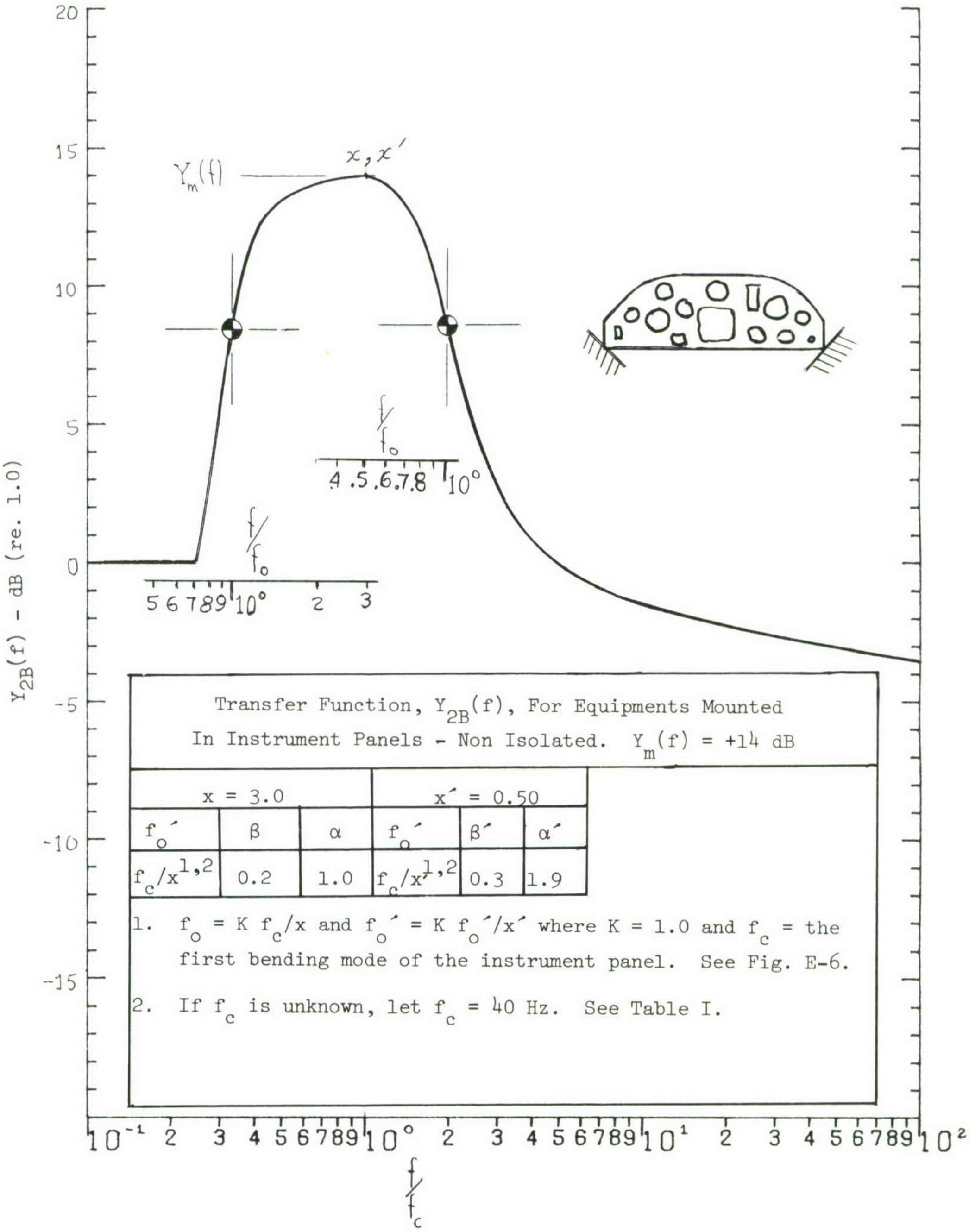
$Y_m(f)$ = +15 dB

x = 1.80			x´ = 0.50		
f_o	β	α	$f_{o'}$	β´	α´
$f_c/x^{1,2}$	0.2	1.0	$f_c/x'^{1,2}$	0.2	1.70

1. $f_o = K\,f_c/x$ and $f_{o'} = K\,f_c/x'$ where K = 1.0 and f_c = the isolator natural frequency.

2. If f_c is unknown, let f_c = 43 Hz. See Table I.

Figure E-2a. Transfer Function for Category II(a)

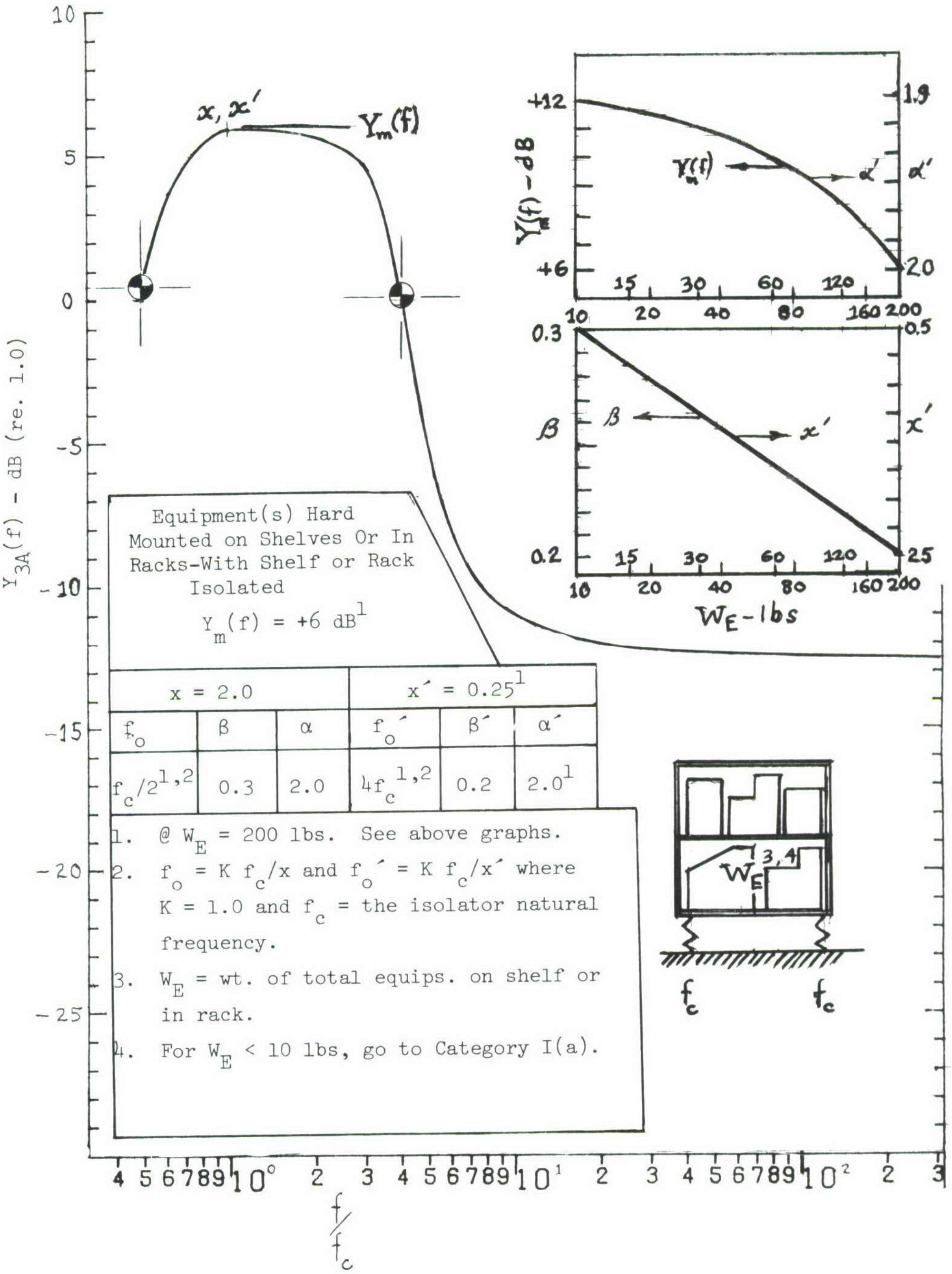


Transfer Function, $Y_{2B}(f)$, For Equipments Mounted In Instrument Panels - Non Isolated. $Y_m(f)$ = +14 dB

$x = 3.0$			$x' = 0.50$		
f_o'	β	α	f_o'	β'	α'
$f_c/x^{1,2}$	0.2	1.0	$f_c/x'^{1,2}$	0.3	1.9

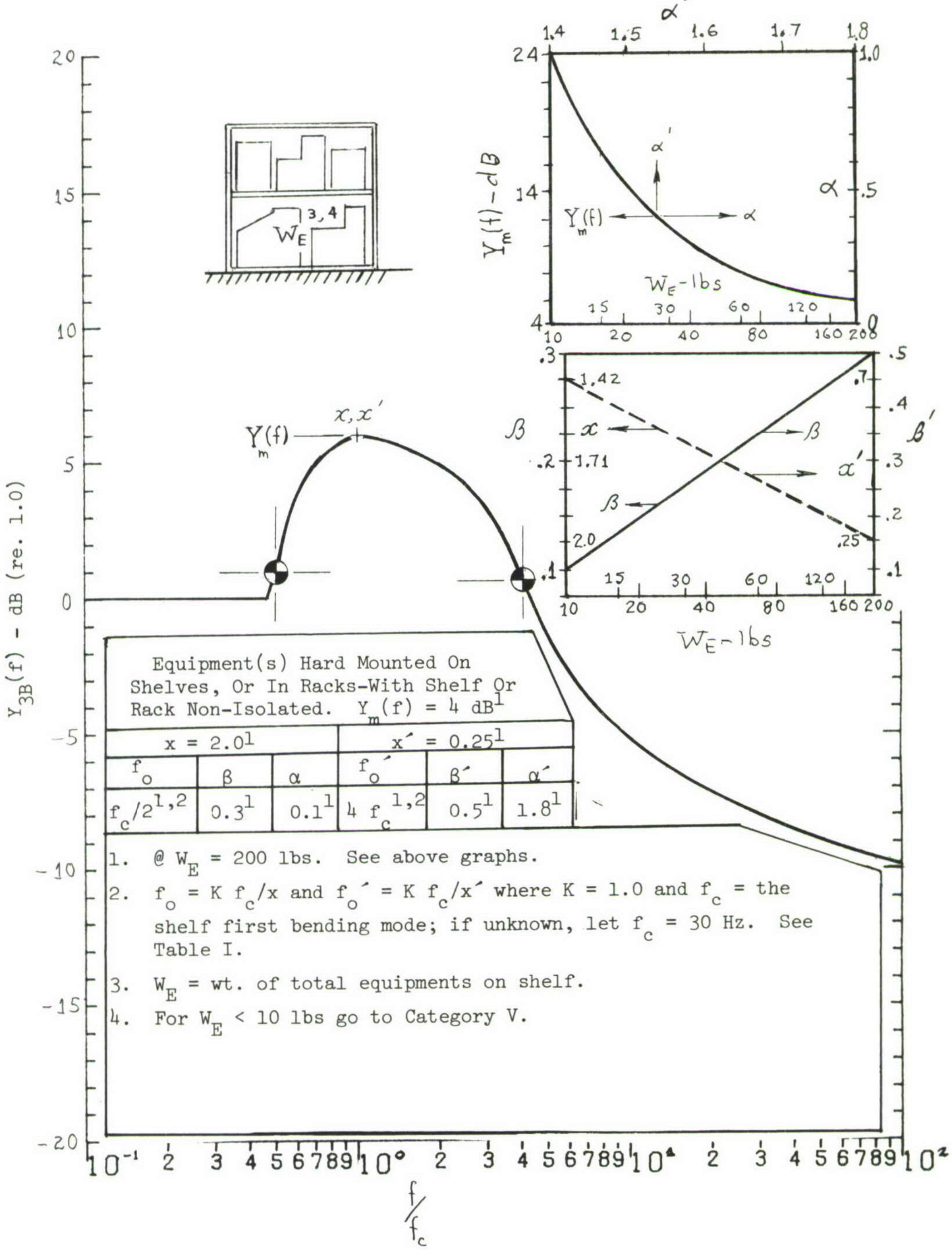
1. $f_o = K\ f_c/x$ and $f_o' = K\ f_o'/x'$ where K = 1.0 and f_c = the first bending mode of the instrument panel. See Fig. E-6.
2. If f_c is unknown, let f_c = 40 Hz. See Table I.

Figure E-2b. Transfer Function for Category II(b)



x = 2.0			x´ = 0.25[1]		
f_o	β	α	f_o'	β´	α´
$f_c/2$[1,2]	0.3	2.0	$4f_c$[1,2]	0.2	2.0[1]

Figure E-3a. Transfer Function for Category III(a)



Equipment(s) Hard Mounted On Shelves, Or In Racks-With Shelf Or Rack Non-Isolated. $Y_m(f) = 4$ dB[1]

$x = 2.0$[1]			$x' = 0.25$[1]		
f_o	β	α	f_o'	β'	α'
$f_c/2$[1,2]	0.3[1]	0.1[1]	4 f_c[1,2]	0.5[1]	1.8[1]

1. @ W_E = 200 lbs. See above graphs.
2. $f_o = K\, f_c/x$ and $f_o' = K\, f_c/x'$ where K = 1.0 and f_c = the shelf first bending mode; if unknown, let f_c = 30 Hz. See Table I.
3. W_E = wt. of total equipments on shelf.
4. For W_E < 10 lbs go to Category V.

Figure E-3b. Transfer Function for Category III(b)

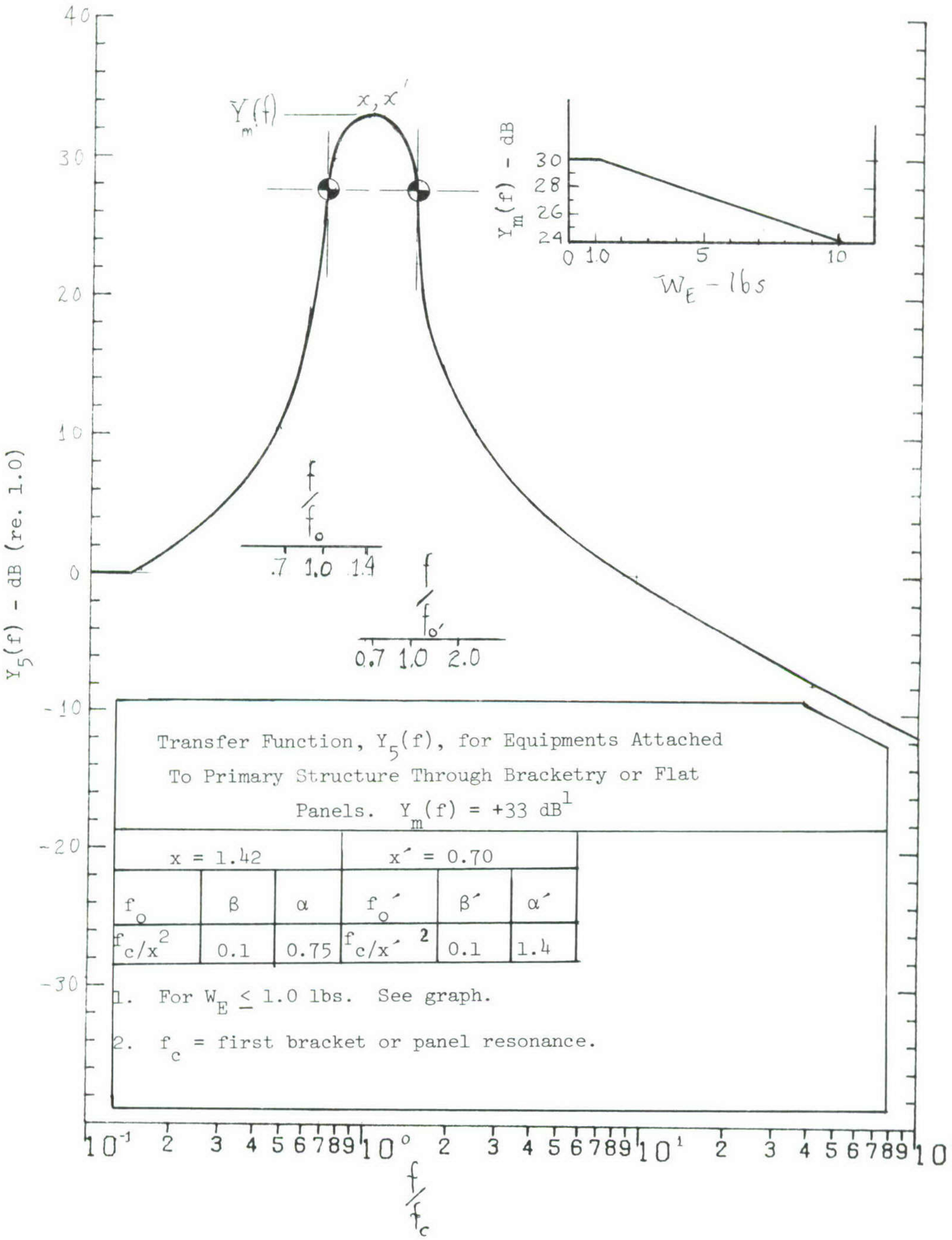


Figure E-4. Transfer Function for Category V

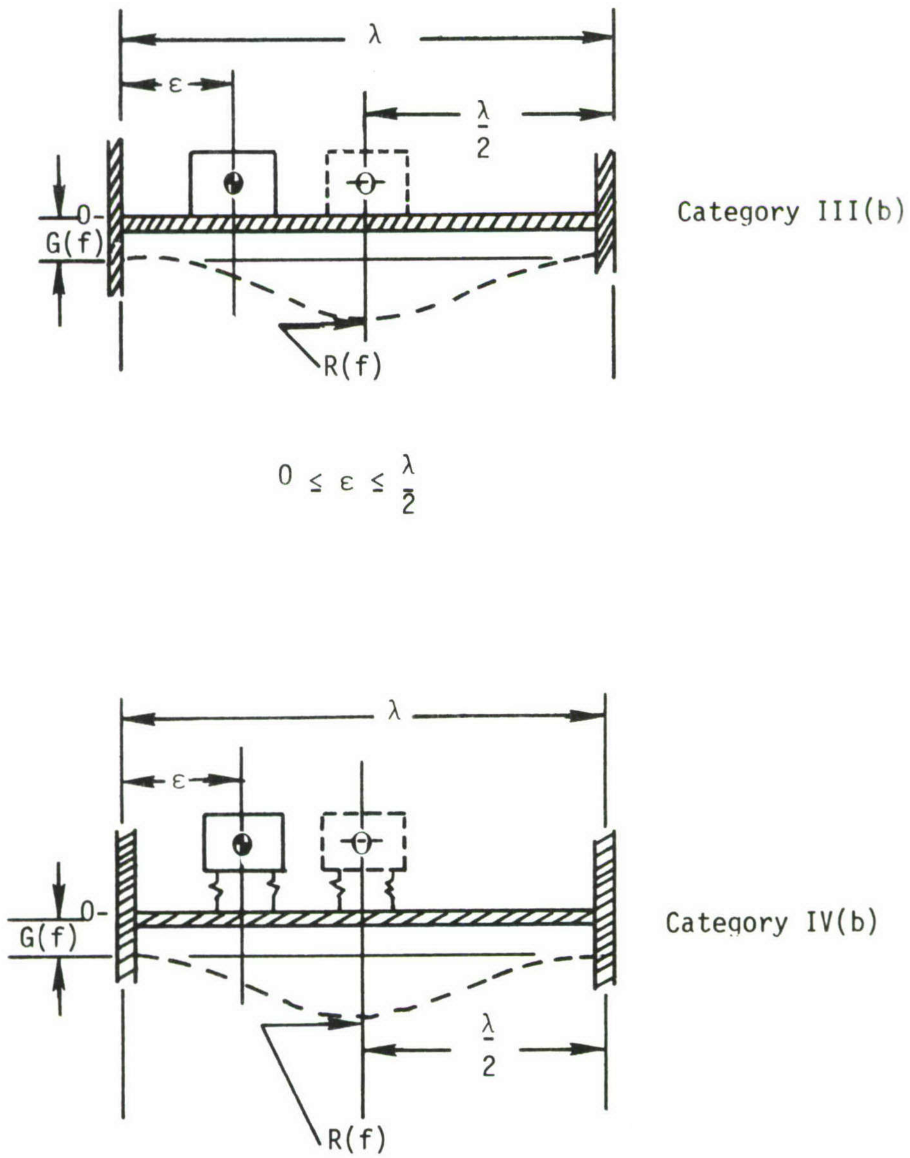


Figure E-5. Midspan Location of R(f)

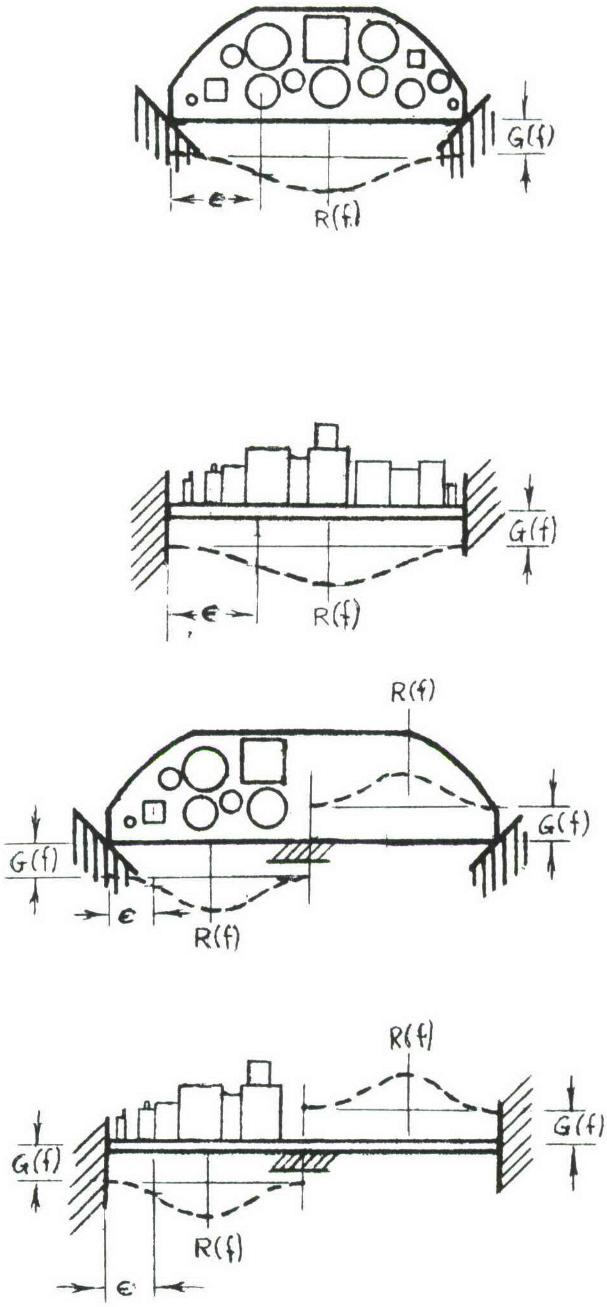
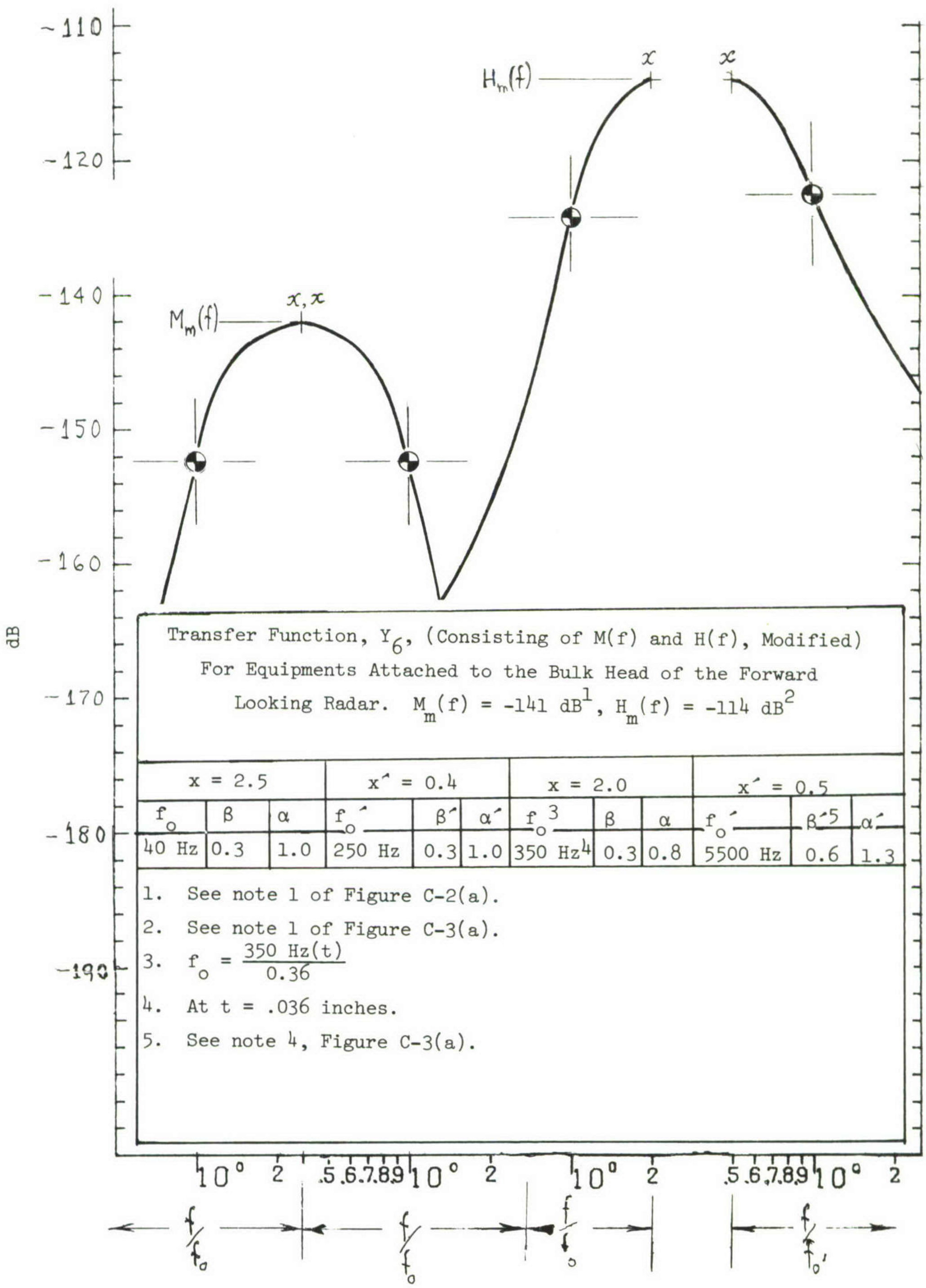


Figure E-6. Midspan Locations of R(f) for Instrument Panels



Transfer Function, Y_6, (Consisting of M(f) and H(f), Modified) For Equipments Attached to the Bulk Head of the Forward Looking Radar. $M_m(f) = -141$ dB[1], $H_m(f) = -114$ dB[2]

x = 2.5			x´ = 0.4			x = 2.0			x´ = 0.5		
f_o	β	α	f_o'	β´	α´	f_o[3]	β	α	f_o'	β´[5]	α´
40 Hz	0.3	1.0	250 Hz	0.3	1.0	350 Hz[4]	0.3	0.8	5500 Hz	0.6	1.3

1. See note 1 of Figure C-2(a).
2. See note 1 of Figure C-3(a).
3. $f_o = \frac{350 \text{ Hz}(t)}{0.36}$
4. At t = .036 inches.
5. See note 4, Figure C-3(a).

Figure E-7. Transfer Function for Category VI

APPENDIX F

COMPUTER PROGRAM

```
              74/74    OPT=1                              FTN 4.5+414        08/16/77  13.11.28

      PROGRAM VIPRF(INPUT,OUTPUT,TAPE5=INPUT,PLFILE)                            VIPRF         2
C     AHFHI   FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR H(F)                           VIPRF         3
C     AHFLO   FORM FACTOR, LOW-FREQ.ROLL-OFF,FOR H(F)                           VIPRF         4
C     AHFMAX  MAXIMUM VALUE OF H(F)                                             VIPRF         5
C     AHI     FORM FACTOR,HIGH-FREQ.ROLL-OFF=FORM FACTOR OF Y(F) FOR            VIPRF         6
C             SPECIFIED CATEGORY                                                VIPRF         7
C     AK      WORKING VAR.USED WHEN CALCULATING FZHFHI                          VIPRF         8
C     ALFHI   FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR L(F)                           VIPRF         9
C     ALFLO   FORM FACTOR, LOW-FREQ.ROLL-OFF,FOR L(F)                           VIPRF        10
C     ALNAHI  FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE             VIPRF        11
C     ALNALO  FORM FACTOR, LOW-FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE             VIPRF        12
C     ALNBHI  SLOPE FACTOR,HIGH-FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE            VIPRF        13
C     ALNBLO  SLOPE FACTOR, LOW-FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE            VIPRF        14
C     ALNMAX  MAXIMUM VALUE OF S(F)-LANDING PHASE                               VIPRF        15
C     ALNXHI  NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE         VIPRF        16
C     ALNXLO  NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF,FOR S(F)-LANDING PHASE         VIPRF        17
C     ALO     FORM FACTOR,LOW FREQ.ROLL-OFF=FORM FACTOR OF Y(F) FOR             VIPRF        18
C             SPECIFIED CATEGORY                                                VIPRF        19
C     ALPHA   ARRAY USED FOR STORING FORM FACTORS OF TRANSFER FUNCTIONS         VIPRF        20
C             WHEN CALCULATING L(F)-M(F)-H(F)                                   VIPRF        21
C     ALT     ARRAY USED FOR STORING INPUT ALTITUDE VALUES                      VIPRF        22
C     ALTTUD  ARRAY USED FOR STORING ALTITUDE TABULAR VALUES                    VIPRF        23
C     AL2FHI  FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR L (F)                          VIPRF        24
C                                                2                              VIPRF        25
C     AL2FLO  FORM FACTOR, LOW-FREQ.ROLL-OFF,FOR L (F)                          VIPRF        26
C                                                2                              VIPRF        27
C     AMAKNO  MACH NO.                                                          VIPRF        28
C     AMFHI   FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR M(F)                           VIPRF        29
C     AMFLO   FORM FACTOR, LOW-FREQ.ROLL-OFF,FOR M(F)                           VIPRF        30
C     AMFMAX  MAXIMUM VALUE OF M(F)                                             VIPRF        31
C     APFHI   FORM FACTOR,HIGH-FREQ.ROLL-OFF,FOR P(F)                           VIPRF        32
C     AVDENS  ARRAY USED FOR STORING AVERAGE DENSITY TABULAR VALUES             VIPRF        33
C     AVP     ARRAY USED FOR STORING AVERAGE PRESSURE TABULAR VALUES            VIPRF        34
C     BBLFHI  SLOPE FACTOR,HIGH-FREQ.ROLL-OFF,FOR L(F)-INITIAL VALUE            VIPRF        35
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      C   IFN    =1HN OR 2H2N FOR SUBSCRIPT IN PRINT OF F  OR F                  VIPRF      282
      C                                                N    2N                   VIPRF      283
      C   IFNISH =6HFINISH USED FOR COMPARE WITH CONTENTS OF COL.1-6            VIPRF      284
      C          OF INPUT DATA CARDS                                             VIPRF      285
      C   IF111  =8H   F-111 FOR COMPARE WITH IPLANE(1)                          VIPRF      286
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      C     IF15    =7H    F-15 FOR COMPARE WITH IPLANE(1)                             VIPRF      287
      C     IF16    =7H    F-16 FOR COMPARE WITH IPLANE(1)                             VIPRF      288
      C     IF4     =6H    F-4 FOR COMPARE WITH IPLANE(1)                              VIPRF      289
      C     IHOLD   ARRAY FOR STORING CONTENTS OF APPARENT "DESCRIPTION"               VIPRF      290
      C             INPUT,DATA CARD AFTER RETURN FROM SUBROUTINE "READCDS"             VIPRF      291
      C     II      WORKING INTEGER VARIABLE                                           VIPRF      292
      C     ILAND   =7HLANDING FOR LANDING FLIGHT PHASE                                VIPRF      293
      C     ILINE1  ARRAY FOR STORING PLOT TITLE LINE CHARACTERS                       VIPRF      294
      C     ILINE2  ARRAY FOR STORING PLOT TITLE LINE CHARACTERS                       VIPRF      295
      C     IMAG    =1HM FOR MAGNESIUM                                                 VIPRF      296
      C     INCPLT  VALUE(BLANKS OR NOT BLANKS) DETERMINES WHETHER THE PLOTS OF        VIPRF      297
      C             TRANSFER AND RESPONSE FUNCTIONS ARE PRODUCED                       VIPRF      298
      C     IPHASE  SET EQUAL TO CHAR.COMB.DENOTING FLIGHT PHASE,REQUIRED FOR F        VIPRF      299
      C     IPLANE  ARRAY FOR STORING INPUT VALUES FOR INPUT DATA IDENTIFICATIC        VIPRF      300
      C     IPLOT   INTEGER VARIABLE FOR COUNT OF PLOTS                                VIPRF      301
      C     ISANDL  =5HSANDL,DENOTING S AND L FLIGHT PHASE                             VIPRF      302
      C     ISTEEL  =1HS,DENOTING STEEL PLATE MATERIAL                                 VIPRF      303
      C     ITAKOF  =7HTAKEOFF,DENOTING TAKEOFF FLIGHT PHASE                           VIPRF      304
      C     ITITAN  =1HT,DENOTING TITANIUM PLATE MATERIAL                              VIPRF      305
      C     ITITL1  ARRAY FOR STORING PLOT TITLE LINE CHARACTERS                       VIPRF      306
      C     ITURB   =2HTB,FOR LOW FREQ. ATMOS. TURBULENCE                              VIPRF      307
      C     IX      INTEGER VARIABLE FOR SUBSCRIPT IN PRINT OF X   ,X ,X OR X          VIPRF      308
      C                                                        RT  T  L    E           VIPRF      309
      C     J       INTEGER WORKING VARIABLE                                           VIPRF      310
      C     JFLITE  INPUT VALUE FOR FLIGHT PHASE                                       VIPRF      311
      C     K       INTEGER WORKING VARIABLE                                           VIPRF      312
      C     L       INTEGER WORKING VARIABLE                                           VIPRF      313
      C     LXNAME  ARRAY FOR STORING CHARACTERS FOR NAME OF X-AXIS ON PLOT            VIPRF      314
      C     LYNAME  ARRAY FOR STORING CHARACTERS FOR NAME OF Y-AXIS ON PLOT            VIPRF      315
      C     M       INTEGER WORK VARIABLE                                              VIPRF      316
      C     MATERL  INPUT VALUE FOR PLATE MATERIAL                                     VIPRF      317
      C     NBFZPF  NUMBER OF B' VALUES IN ARRAY "BFZPF"                               VIPRF      318
      C     NC3     NUMBER OF TABULAR VALUES FOR CATEGORY 3,Y(F) PARAMETERS            VIPRF      319
      C     NDBP    NUMBER OF DECIBEL VALUES STORED IN ARRAY "DDBVAL"                  VIPRF      320
      C     NMERS   NUMBER OF DECIBEL VALUES IN ARRAY "DBMERS"                         VIPRF      321
      C     NMODE1  NUMBER OF DECIBEL VALUES IN ARRAY "DBMOD1"                         VIPRF      322
      C     NMODE2  NUMBER OF DECIBEL VALUES IN ARRAY "DBMOD2"                         VIPRF      323
      C     NPTS    NUMBER OF POINTS CALCULATED FOR FUNCTION L(F)-M(F)-H(F)            VIPRF      324
      C     NRSVAL  NUMBER OF TABULAR VALUES OF R  USED WHEN CALC. F' FOR H(F)         VIPRF      325
      C                                         S                 0                    VIPRF      326
      C             CORRECTION TO M(F) AND H(F) FOR R                                  VIPRF      327
      C                                             S                                  VIPRF      328
      C     NWE100  NUMBER OF DB VALUES IN ARRAY WE100                                 VIPRF      329
      C     NWE1K   NUMBER OF DB VALUES IN ARRAY WE1000                                VIPRF      330
      C     NWE5K   NUMBER OF DB VALUES IN ARRAY WE5000                                VIPRF      331
      C     N1A10   NUMBER OF DECIBEL VALUES IN ARRAY "DB1A10"                         VIPRF      332
      C     N1A7D   NUMBER OF DECIBEL VALUES IN ARRAY "DB1A7D"                         VIPRF      333
      C     N1F15   NUMBER OF DECIBEL VALUES IN ARRAY "DB1F15"                         VIPRF      334
      C     N1F16   NUMBER OF DECIBEL VALUES IN ARRAY "DB1F16"                         VIPRF      335
      C     N1F4    NUMBER OF DECIBEL VALUES IN ARRAY "DB1F4"                          VIPRF      336
      C     N1F111  NUMBER OF DECIBEL VALUES IN ARRAY "DB1111"                         VIPRF      337
      C     N2A10   NUMBER OF DECIBEL VALUES IN ARRAY "DB2A10"                         VIPRF      338
      C     N2A7D   NUMBER OF DECIBEL VALUES IN ARRAY "DB2A7D"                         VIPRF      339
      C     N2F15   NUMBER OF DECIBEL VALUES IN ARRAY "DB2F15"                         VIPRF      340
      C     N2F16   NUMBER OF DECIBEL VALUES IN ARRAY "DB2F16"                         VIPRF      341
      C     N2F4    NUMBER OF DECIBEL VALUES IN ARRAY "DB2F4"                          VIPRF      342
      C     N2F111  NUMBER OF DECIBEL VALUES IN ARRAY DB2111                           VIPRF      343
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      C     PEAK    MAXIMUM OF Y(F) FOR SPECIFIED CATEGORY                    VIPRF      344
      C                                         2                             VIPRF      345
      C     PEM     MAXIMUM OF P(F),PSF./HZ.                                  VIPRF      346
      C     PEMDB   MAXIMUM OF P(F),DB.                                       VIPRF      347
      C     PI      CONSTANT=3.14159265                                       VIPRF      348
      C     PNORM   RATIO:AV.PRESSURE AT ALTITUDE/AV.PRESSURE AT SEA LEVEL ALTI VIPRF      349
      C     QSQ     SQUARE OF Q,DYNAMIC PRESSURE                              VIPRF      350
      C     R       AVERAGE DENSITY                                           VIPRF      351
      C     REX     RE ,REYNOLDS NUMBER AT DISTANCE X                         VIPRF      352
      C               X                                                       VIPRF      353
      C     RNORM   RATIO:AV.DENSITY AT ALTITUDE/AV.DENSITY AT SEA LEVEL ALTITU VIPRF      354
      C     RS      INPUT VALUE FOR DISTANCE FROM SKIN,R                      VIPRF      355
      C                                                 S                     VIPRF      356
      C     PSMAX   MAX.VALUE OF P  COVERED BY ARRAY OF TABULAR,DECIBEL VALUES, VIPRF      357
      C                           S                                           VIPRF      358
      C     RSVALS  ARRAY FOR STORING TABULAR DECIBEL VALUES USED WHEN CALCULAT VIPRF      359
      C             F' FOR H(F) AND CORRECTION TO M(F) AND H(F) FOR R         VIPRF      360
      C              0                                                S       VIPRF      361
      C     SAHI    SET EQUAL TO FORM FACTOR,HF ROLL-OFF FOR S(F) OF SPEC.FLIGH VIPRF      362
      C     SALO    SET EQUAL TO FORM FACTOR,LF ROLL-OFF FOR S(F) OF SPEC.FLIGH VIPRF      363
      C     SBHI    SET EQUAL TO SLOPE FACTOR,HF ROLL-OFF FOR S(F) OF SPEC.FLIG VIPRF      364
      C     SBLO    SET EQUAL TO SLOPE FACTOR,LF ROLL-OFF FOR S(F) OF SPEC.FLIG VIPRF      365
      C     SBFTD   RATIO:S (F)/S (F)' FOR CALC. S (F) CORRES.TO A D>0,USING IN VIPRF      366
      C                    BT M  BT M              BT M                       VIPRF      367
      C             VALUE FOR PHEMAX                                          VIPRF      368
      C     SDELTA  VALUE OF S (F) AT FMINGE                                  VIPRF      369
      C                       BT                                              VIPRF      370
      C     SFZHI   SET EQUAL TO LOCATOR FREQ.,HIGH FREQ.ROLL-OFF,FOR S(F)    VIPRF      371
      C             OF SPEC.FLIGHT PHASE                                      VIPRF      372
      C     SFZLO   SET EQUAL TO LOCATOR FREQ., LOW FREQ.ROLL-OFF,FOR S(F)    VIPRF      373
      C             OF SPEC.FLIGHT PHASE                                      VIPRF      374
      C     SIGN    ARRAY FOR STORING VALUE 0 OR VALUE 1,DENOTING LOW-FREQ.AND VIPRF      375
      C             HIGH-FREQ.ROLL-OFF,RESP.,WHEN CALC. L(F)-M(F)-H(F)        VIPRF      376
      C     SOUND   ARRAY FOR STORING TABULAR VALUES FOR VELOCITY OF SOUND    VIPRF      377
      C     SPEAK   SET EQUAL TO MAXIMUM VALUE OF S(F) FOR SPEC.FLIGHT PHASE  VIPRF      378
      C     SXHI    SET EQUAL TO NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF FOR S(F)  VIPRF      379
      C             OF SPEC.FLIGHT PHASE                                      VIPRF      380
      C     SXLO    SET EQUAL TO NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF FOR S(F)  VIPRF      381
      C             OF SPEC.FLIGHT PHASE                                      VIPRF      382
      C     T       INPUT VALUE FOR AIRCRAFT PLATE THICKNESS                  VIPRF      383
      C     TAKAHI  FORM FACTOR,HIGH FREQ.ROLL-OFF,FOR S(F) OF TAKE-OFF FLIGHT VIPRF      384
      C     TAKALO  FORM FACTOR, LOW FREQ.ROLL-OFF,FOR S(F) OF TAKE-OFF FLIGHT VIPRF      385
      C     TAKBHI  SLOPE FACTOR,HIGH-FREQ.ROLL-OFF,FOR S(F) OF TAKE-OFF FLIGHT VIPRF      386
      C     TAKBLO  SLOPE FACTOR, LOW-FREQ.ROLL-OFF,FOR S(F) OF TAKE-OFF FLIGHT VIPRF      387
      C     TAKMAX  MAXIMUM VALUE OF SPECIAL FUNCTION S(F) FOR TAKE-OFF FLIGHT VIPRF      388
      C     TAKXHI  NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF,FOR S(F),TAKE-OFF FLIGHT VIPRF      389
      C     TAKXLO  NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF,FOR S(F),TAKE-OFF FLIGHT VIPRF      390
      C     TBAHI   FORM FACTOR,HIGH FREQ. ROLL-OFF,FOR S(F) OF LOW FREQ.     VIPRF      391
      C             ATMOS.TURBULENCE PHASE                                    VIPRF      392
      C     TBBHI   SLOPE FACTOR,HIGH FREQ.ROLL-OFF,FOR S(F) FOR LOW FREQ.    VIPRF      393
      C             ATMOS. TURBULENCE                                         VIPRF      394
      C     TBFC    CENTER FREQ.OF HIGH FREQ. ROLL-OFF SECTION OF S(F) FOR    VIPRF      395
      C             LOW FREQ. ATMOS.TURBULENCE PHASE                          VIPRF      396
      C     TBREF   VALUE(REFERENCE) OF S(F) AT FREQ=F' USED WHEN CALC. MAXIMUM VIPRF      397
      C                                               0                       VIPRF      398
      C             VALUE OF S(F) AT FREQ.=TBFC                               VIPRF      399
      C     TICLEN  LENGTH OF TICK MARK ON RIGHT HAND Y AXIS OF PLOT          VIPRF      400
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      C    TWOB    ARRAY FOR STORING VALUES OF BETA AND BETA' FOR L(F),M(F) AN VIPRF      401
      C            H(F),USED WHEN CALCULATING L(F)-M(F)-H(F) TRANSFER FUNCTION VIPRF      402
      C    TWOBPF  TWICE BETA' FOR P(F)                                        VIPRF      403
      C    U       FREE-STREAM VELOCITY                                        VIPRF      404
      C    V       AVERAGE KINEMATIC VISCOSITY                                 VIPRF      405
      C    VALK    ARRAY FOR STORING VALUES OF K USED WHEN CALCULATING F' FOR  VIPRF      406
      C                                                                 C      VIPRF      407
      C    VISCOS  ARRAY FOR STORING TABULAR VALUES OF AVERAGE KINEMATIC VISCO VIPRF      408
      C    VNCRM   RATIO:AV.KINEMATIC VISCOSITY AT ALTITUDE/AV.KINEMATIC VISCO VIPRF      409
      C            AT SEALEVEL ALTITUDE                                        VIPRF      410
      C    WE      INPUT VALUE FOR EQUIPMENT WEIGHT                            VIPRF      411
      C    WEK     ARRAY FOR STORING TABULAR VALUES OF EQUIPMENT WEIGHT USED W VIPRF      412
      C            CALCULATING F' FOR H(F)                                     VIPRF      413
      C                           C                                            VIPRF      414
      C    WEMAX   MAXIMUM VALUE OF EQUIPMENT WEIGHT,WE,FOR TABULAR DECIBEL    VIPRF      415
      C            VALUES STORED IN ARRAY"WE5000"                              VIPRF      416
      C    WE100   ARRAY FOR STORING DECIBEL VALUES CORRESPONDING TO EQUIP.WEI VIPRF      417
      C            UP TO 100LBS.,USED WHEN CALC.CORRECTION TO MAXIMUM OF H(F)  VIPRF      418
      C    WE1000  ARRAY FOR STORING DECIBEL VALUES CORRESPONDING TO EQUIP.WEI VIPRF      419
      C            UP TO 1000LBS.,USED WHEN CALC.CORRECTION TO MAXIMUM OF H(F) VIPRF      420
      C    WE5000  ARRAY FOR STORING DECIBEL VALUES CORRESPONDING TO EQUIP.WEI VIPRF      421
      C            UP TO 5000LBS.,USED WHEN CALC.CORRECTION TO MAXIMUM OF H(F) VIPRF      422
      C    WS      DENSITY OF AIRCRAFT PLATE MATERIAL                          VIPRF      423
      C    X       DISTANCE X ,X  OR X                                         VIPRF      424
      C                       F  BT    TL                                      VIPRF      425
      C    XAXIS   LENGTH OF X AXIS OF PLOTS                                   VIPRF      426
      C    XBT     BT DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAM VIPRF      427
      C            PROFILE TO THE WING CHORD CENTER                            VIPRF      428
      C    XCYCLE  LENGTH OF LOGARITHMIC CYCLE FOR XAXIS OF PLOT               VIPRF      429
      C    XE      E DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE AERODYNAMI VIPRF      430
      C            PROFILE TO THE WING CHORD CENTER                            VIPRF      431
      C    XFFRMX  ARRAY FOR STORING THE MAXIMUM VALUES OF L(F),L (F),M(F) AND VIPRF      432
      C                                                       2                VIPRF      433
      C            TRANSFER FUNCTIONS USED WHEN CALCULATING L(F)-M(F)-H(F)     VIPRF      434
      C    XHFCCR  MAXIMUM VALUE OF H(F) CORRECTED FOR W ,W  AND R             VIPRF      435
      C                                                 E  S      S            VIPRF      436
      C    XHFHI   NORM.FREQ.RATIO,HIGH-FREQ.ROLL-OFF,H(F) OF CURRENT FLIGHT P VIPRF      437
      C    XHFLC   NORM.FREQ.RATIO, LOW-FREQ.ROLL-OFF,H(F) OF CURRENT FLIGHT P VIPRF      438
      C    XHFMAX  MAXIMUM VALUE OF H(F) BEFORE CORRECTION                     VIPRF      439
      C    XHI     SET EQUAL TO NORM.FREQ.RATIO,HIGH-FREQ.ROLL-OFF,FOR SPEC.Y( VIPRF      440
      C    XLFCCR  MAXIMUM VALUE OF L(F) CORRECTED FOR X                       VIPRF      441
      C                                                E                       VIPRF      442
      C    XLFHI   NORM.FREQ.RATIO,HIGH-FREQ.ROLL-OFF,FOR L(F)                 VIPRF      443
      C    XLFLC   NORM.FREQ.RATIO, LOW-FREQ.ROLL-OFF,FOR L(F)                 VIPRF      444
      C    XLFMAX  MAXIMUM VALUE OF L(F) BEFORE CORRECTION                     VIPRF      445
      C    XLC     SET EQUAL TO NORM.FREQ.RATIO,LOW-FREQ.ROLL-OFF,FOR SPEC.Y(F VIPRF      446
      C    XL2FCR  MAXIMUM VALUE OF L (F) AFTER CORRECTION FOR X               VIPRF      447
      C                              2                         E               VIPRF      448
      C    XL2FHI  NORM.FREQ.RATIO,HIGH-FREQ.ROLL-OFF,FOR L (F)                VIPRF      449
      C                                                    2                   VIPRF      450
      C    XL2FLC  NORM.FREQ.RATIO, LOW-FREQ.ROLL-OFF,FOR L (F)                VIPRF      451
      C                                                    2                   VIPRF      452
      C    XL2FMX  MAXIMUM VALUE OF L (F)                                      VIPRF      453
      C                              2                                         VIPRF      454
      C    XMAKNO  MACH NO. OF CURRENT AIRCRAFT PROFILE ANALYSIS               VIPRF      455
      C    XMFCCR  MAXIMUM VALUE OF M(F),CORRECTED FOR "WS"AND"RS"             VIPRF      456
      C    XMFHI   NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF,FOR M(F)                 VIPRF      457
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C      XMFLO   NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF,FOR M(F)                    VIPRF      458
C      XMFMAX  MAXIMUM VALUE OF M(F)                                           VIPRF      459
C      XRF     NORM.FREQ.RATIO,HIGH-FREQ.ROLL-OFF,FOR R(F)                     VIPRF      460
C      XTL     "T" OR "L" DISTANCE FROM THE LEADING EDGE OF THE FUSELAGE       VIPRF      461
C              AERODYNAMIC PROFILE TO THE LANDING GEAR                         VIPRF      462
C      XVAL    X COORDINATE OF LOWER LEFT-HAND CORNER OF INFO.LINE PLT ON      VIPRF      463
C              PLOT BY DISSPLA SUB-ROUTINE "RLMESS"                            VIPRF      464
C      XX      WORKING,REAL VARIABLE                                           VIPRF      465
C      XXHFHI  NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF,FOR H(F)--CONSTANT VALUE VIPRF      466
C      XXHFLO  NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF,FOR H(F)--CONSTANT VALUE VIPRF      467
C      XXLFHI  NORM.FREQ.RATIO,HIGH FREQ.ROLL-OFF,FOR L(F)--CONSTANT VALUE VIPRF      468
C      XXLFLO  NORM.FREQ.RATIO, LOW FREQ.ROLL-OFF,FOR L(F)--CONSTANT VALUE VIPRF      469
C      X1      WORKING VARIABLE                                                VIPRF      470
C      X2      WORKING VARIABLE                                                VIPRF      471
C      X3      WORKING VARIABLE                                                VIPRF      472
C      X4      WORKING VARIABLE                                                VIPRF      473
C      YAXIS   LENGTH OF Y AXIS ON PLOTS                                       VIPRF      474
C      YSTEP   STEP SIZE ,Y DATA UNITS/INCH FOR PLOT Y AXIS                    VIPRF      475
C      YVAL    Y COORDINATE OF LOWER LEFT-HAND CORNER OF INFO.LINE PLT ON      VIPRF      476
C              PLOT BY DISSPLA SUB-ROUTINE "RLMESS"                            VIPRF      477
                                                                               VIPRF      478
                                                                               VIPRF      479
                                                                               VIPRF      480
       DIMENSION FREQ(150),DECBEL(150),DBEL(150),DBSPL(150),FSPL(150)          VIPRF      481
       DIMENSION ALT(6),AMAKNO(6),ALPHA(4),DDBVAL(41),IHOLD(5)                 VIPRF      482
       DIMENSION DB1F4(41),DB2F4(41),DB1F15(41),DB2F15(41)                     VIPRF      483
       DIMENSION DB1F16(55),DB2F16(41),DB1111(41),DB2111(41)                   VIPRF      484
       DIMENSION DB1A70(41),DB2A70(41),DB1A10(41),DB2A10(41)                   VIPRF      485
       DIMENSION WEK(14),VALK(14),C1AAWE(11),C1AMWE(11)                        VIPRF      486
       DIMENSION BFZPF(29),FORIHF(43),DBRS(43),RSVALS(43),WE100(7)             VIPRF      487
       DIMENSION WE1000(7),WE5000(9),DBMFRS(29)                                VIPRF      488
       DIMENSION EB(4),XFFRMX(4),TWOB(4),FLX(4),FZ(4),HILO(4),SIGN(4)          VIPRF      489
       DIMENSION ALTTUD(61),AVP(61),AVDENS(61),SOUND(61),VISCOS(61)            VIPRF      490
       DIMENSION C3WE(10),C3AYMX(10),C3AAP(10),C3AXP(10),C3BB(10),             VIPRF      491
      1C3BX(10),C3BBP(10),C3BXP(10),C3BYMX(10),C3BAP(10),C3BA(10),             VIPRF      492
      2C3AB(10)                                                                VIPRF      493
                                                                               VIPRF      494
                                                                               VIPRF      495
       COMMON/PFLOTT/H,XMAKNO,X,RS,WE,WS,IFLITE,CATGRY,ILINE1(7),              VIPRF      496
      1ITITL1(7),IPLANE(3),LXNAME(4),LYNAME(4),XCYCLE,YSTEP,YAXIS,            VIPRF      497
      2XAXIS,HITE,HITE1,TICLEN,X1,X2,X3,X4,XX,IPHASE,INOPLT,IBLANK            VIPRF      498
                                                                               VIPRF      499
       COMMON/KARES/FN,XLFMAX,F2N,XL2FMX,PUFMAX,XET,XTL,FCMOVE,                VIPRF      500
      1NMODE1,DXMOD1,DBMOD1(100),NMODE2,DXMOD2,DBMOD2(100),                    VIPRF      501
      2ILINE2(8),ISANDL,IBUFET,ITAKOF,ILAND,ITURB,IFNISH                       VIPRF      502
                                                                               VIPRF      503
                                                                               VIPRF      504
       DATA NBFZPF/29/,BFZPF/1.745,1.150,0.900,0.746,0.651,0.592,0.551,        VIPRF      505
      10.530,0.509,0.492,0.480,0.470,0.457,0.454,0.446,0.440,0.435,            VIPRF      506
      20.424,0.421,0.4164,0.4118,0.4072,0.4026,0.3980,0.3934,0.3888,           VIPRF      507
      30.3842,0.3796,0.375/                                                    VIPRF      508
                                                                               VIPRF      509
       DATA RSVALS/0.,0.25,0.50,0.75,1.0,1.25,1.50,1.75,2.0,2.25,2.50,         VIPRF      510
      12.75,3.0,3.5,4.0,4.5,5.0,5.5,6.0,7.0,8.0,9.0,10.0,11.0,12.0,13.0,      VIPRF      511
      214.0,15.0,16.0,17.0,18.0,19.0,20.0,21.0,22.0,23.0,24.0,25.0,26.0,      VIPRF      512
      327.0,28.0,29.0,30.0/                                                    VIPRF      513
                                                                               VIPRF      514
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      DATA CPRS/0.,-2.00,-2.60,-3.30,-3.90,-4.40,-4.80,-5.20,-5.50,
     1-5.90,-6.15,-6.40,-6.80,-7.30,-8.00,-8.50,-9.0,-9.5,-10.0,-10.8,
     2-11.5,-12.0,-12.75,-13.20,-13.70,-14.00,-14.40,-14.60,-14.90,
     3-15.20,-15.35,-15.70,-15.85,-15.95,-16.0,-16.10,-16.20,-16.30,
     4-16.40,-16.50,-16.60,-16.65,-16.70/

      DATA FPRIHF/5500.,3800.,3550.,3350.,3200.,3100.,2950.,2800.,
     12730.,2650.,2560.,2470.,2400.,2320.,2200.,2100.,2000.,1950.,
     21900.,1800.,1754.,1690.,1600.,1580.,1550.,1510.,1480.,1450.,
     31420.,1380.,1360.,1340.,1320.,1305.,1285.,1268.,1256.,1250.,
     41244.,1238.,1232.,1226.,1220./


      DATA WEK/2.5,3.8,5.0,7.5,10.0,15.0,20.0,30.0,40.0,60.0,80.0,100.0,
     1160.0,200.0/
      DATA VALK/1.0,0.99,0.98,0.95,0.92,0.87,0.84,0.76,0.73,0.675,
     10.650,0.608,0.575,0.550/

      DATA NMERS/29/,DXMERS/0.10/
      DATA CEMERS/-17.0,-16.5,-15.0,-13.7,-12.4,-11.2,-10.2,-9.2,-8.1,
     1-7.3,-6.6,-5.8,-5.0,-4.5,-3.9,-3.2,-2.8,-2.2,-2.0,-1.7,-1.2,
     2-1.1,-0.90,-0.70,-0.40,-0.30,-0.20,-0.10,0./

      DATA NC1A/11/,DXC1A/20.0/,XINC1A/10.0/
      DATA C1AAWE/1.0,1.34,1.48,1.57,1.62,1.70,1.75,1.77,1.82,1.86,1.92/
      DATA C1AMWE/0.,-1.0,-1.8,-2.3,-2.8,-3.3,-4.0,-4.5,-5.2,-5.5,-6.5/

      DATA NWE100/7/,DWE100/15.0/
      DATA WE100/0.,-0.5,-1.25,-2.0,-2.5,-3.75,-4.5/
      DATA NWE1K/7/,DWE1K/150.0/
      DATA WE1000/-4.5,-10.0,-12.6,-14.4,-15.2,-16.1,-16.6/
      DATA NWE5K/9/,DWE5K/500.0/
      DATA WE5000/-16.6,-17.85,-18.9,-19.7,-20.15,-20.6,-21.0,-21.25,
     1-21.50/

      DATA NDDB/41/,DELDDB/1.0/
      DATA DDBVAL/0.,-0.02,-0.05,-0.10,-0.20,-0.22,-0.30,
     1-0.44,-0.50,-0.60,-0.80,-1.00,-1.20,-1.40,-1.60,-1.90,-2.20,
     2-2.50,-3.00,-3.50,-4.00,-4.50,-5.10,-5.80,-6.60,-7.50,-8.30,
     3-9.20,-10.10,-11.50,-11.80,-12.70,-13.50,-14.30,-15.00,
     4-15.70,-16.50,-17.20,-17.90,-18.50,-19.10/

      DATA C3WF/10.0,15.0,20.0,30.0,40.0,60.0,90.0,120.0,160.0,200.0/
      DATA C3AYMX/12.0,11.6,11.5,11.0,10.7,10.0,9.6,8.3,7.5,6.0/
      DATA C3AP/0.300,0.285,0.278,0.264,0.257,0.240,0.235,0.220,
     10.213,0.200/
      DATA C3AXF/0.500,0.460,0.445,0.406,0.385,0.350,0.332,0.295,
     10.280,0.250/
      DATA C3AAF/1.900,1.907,1.909,1.918,1.920,1.936,1.940,1.960,
     11.970,2.000/
      DATA C3BYMX/24.0,16.7,14.6,11.2,10.2,8.0,7.4,6.3,6.1,6.0/
      DATA C3BB/0.120,0.130,0.140,0.175,0.190,0.225,0.235,0.265,
     10.283,0.300/
      DATA C3BBF/0.100,0.167,0.190,0.260,0.280,0.350,0.375,0.435,
     10.463,0.500/
      DATA C3BX/1.42,1.52,1.55,1.65,1.69,1.78,1.81,1.89,1.95,2.00/
      DATA C3BXF/0.700,0.625,0.599,0.524,0.494,0.419,0.400,0.333,
```

```
PROGRAM VIPRF       74/74    OPT=1                       FTN 4.5+414        08/16/77   13.11.28

        10.288,0.250/                                                           VIPRF    572
        DATA C3BA/1.00,0.64,0.54,0.36,0.30,0.20,0.175,0.120,0.110,0.10/         VIPRF    573
        DATA C3BAF/1.40,1.46,1.50,1.56,1.58,1.64,1.68,1.73,1.75,1.80/           VIPRF    574
                                                                                VIPRF    575
        DATA ALTITD/ 0.,500.,1000.,1500.,2000.,2500.,3000.,3500.,4000.,         VIPRF    576
       * 4500., 5000., 5500., 6000., 6500., 7000., 7500., 8000., 8500.,         VIPRF    577
       * 9000., 9500.,10000.,11000.,12000.,13000.,14000.,15000.,16000.,         VIPRF    578
       *17000.,18000.,19000.,20000.,21000.,22000.,23000.,24000.,25000.,         VIPRF    579
       *26000.,27000.,28000.,29000.,30000.,31000.,32000.,33000.,34000.,         VIPRF    580
       *35000.,36000.,37000.,38000.,39000.,40000.,41000.,42000.,43000.,         VIPRF    581
       *44000.,45000.,46000.,47000.,48000.,49000.,50000./                       VIPRF    582
                                                                                VIPRF    583
        DATA AVP/2116.2,2078.3,2040.9,2004.0,1967.7,1931.9,1896.6,1861.9,       VIPRF    584
       *1827.7,1794.0,1760.8,1728.1,1695.9,1664.2,1632.9,1602.2,1571.9,         VIPRF    585
       *1542.1,1512.7,1483.8,1455.3,1399.7,1345.9,1293.7,1243.2,1194.3,         VIPRF    586
       *1146.9,1101.1,1056.8,1013.9, 972.5, 932.4, 893.7, 856.3, 820.2,         VIPRF    587
       *785.3,751.6,719.1,687.8,657.6,628.4,600.3,573.3,547.2,522.1,498.0,      VIPRF    588
       *474.7,452.4,431.2,411.0,391.7,373.3,355.8,339.1,323.2,308.0,293.6,      VIPRF    589
       *279.8,266.7,254.1,242.2/                                                VIPRF    590
                                                                                VIPRF    591
        DATA AVDENS/.2513E-02,.2467E-02,.2422E-02,.2377E-02,.2334E-02,          VIPRF    592
       *.2291E-02,.2249E-02,.2210E-02,.2173E-02,.2137E-02,.2102E-02,            VIPRF    593
       *.2067E-02,.2033E-02,.1999E-02,.1965E-02,.1932E-02,.1900E-02,            VIPRF    594
       *.1868E-02,.1836E-02,.1805E-02,.1774E-02,.1718E-02,.1663E-02,            VIPRF    595
       *.1611E-02,.1559E-02,.1508E-02,.1458E-02,.1411E-02,.1364E-02,            VIPRF    596
       *.1318E-02,.1273E-02,.1230E-02,.1188E-02,.1147E-02,.1107E-02,            VIPRF    597
       *.1068E-02,.1030E-02,.9933E-03,.9577E-03,.9228E-03,.8890E-03,            VIPRF    598
       *.8536E-03,.8189E-03,.7853E-03,.7529E-03,.7215E-03,.6912E-03,            VIPRF    599
       *.6621E-03,.6341E-03,.6074E-03,.5918E-03,.5573E-03,.5338E-03,            VIPRF    600
       *.5113E-03,.4898E-03,.4692E-03,.4495E-03,.4306E-03,.4125E-03,            VIPRF    601
       *.3952E-03,.3786E-03/                                                    VIPRF    602
                                                                                VIPRF    603
        DATA SOUND/1090.6,1090.4,1090.3,1090.1,1090.,1089.8,1089.7,1089.0,      VIPRF    604
       *1087.8,1086.7,1085.5,1084.3,1083.1,1081.9,1080.7,1079.5,1078.4,         VIPRF    605
       *1077.1,1075.9,1074.7,1073.4,1069.6,1065.9,1062.1,1058.4,1054.5,         VIPRF    606
       *1050.7,1046.9,1043.1,1039.2,1035.4,1031.5,1027.5,1023.6,1019.7,         VIPRF    607
       *1015.8,1011.8,1007.8,1003.8, 999.7, 995.7, 993.1, 990.7, 988.2,         VIPRF    608
       *985.7,983.3,980.8,978.3,975.8,973.3,970.9,968.5,966.0,963.6,961.1,      VIPRF    609
       *958.8,956.3,954.0,951.6,949.2,946.9/                                    VIPRF    610
                                                                                VIPRF    611
        DATA VISCOS/.1467E-03,.1492E-03,.1517E-03,.1543E-03,.1570E-03,          VIPRF    612
       *.1597E-03,.1625E-03,.1651E-03,.1675E-03,.1699E-03,.1724E-03,            VIPRF    613
       *.1749E-03,.1775E-03,.1802E-03,.1828E-03,.1856E-03,.1883E-03,            VIPRF    614
       *.1911E-03,.1940E-03,.1969E-03,.1998E-03,.2051E-03,.2106E-03,            VIPRF    615
       *.2163E-03,.2222E-03,.2283E-03,.2346E-03,.2411E-03,.2478E-03,            VIPRF    616
       *.2551E-03,.2621E-03,.2696E-03,.2774E-03,.2854E-03,.2938E-03,            VIPRF    617
       *.3025E-03,.3115E-03,.3208E-03,.3306E-03,.3407E-03,.3512E-03,            VIPRF    618
       *.3639E-03,.3775E-03,.3917E-03,.4066E-03,.4223E-03,.4387E-03,            VIPRF    619
       *.4559E-03,.4738E-03,.4925E-03,.5118E-03,.5320E-03,.5530E-03,            VIPRF    620
       *.5749E-03,.5976E-03,.6213E-03,.6460E-03,.6717E-03,.6984E-03,            VIPRF    621
       *.7263E-03,.7554E-03/                                                    VIPRF    622
                                                                                VIPRF    623
        DATA ISTEEL,ITITAN,IALUM,IMAG/1HS,1HT,1HA,1HM/                          VIPRF    624
                                                                                VIPRF    625
        DATA C1A/2H1A/,C2A/2H2A/,C2B/2H2B/,C3A/2H3A/,C3B/2H3B/,C5/1H5/          VIPRF    626
        DATA C1B/2H1B/,C4A/2H4A/,C4B/2H4B/,C6/1H6/,IBLANK/1H /                  VIPRF    627
                                                                                VIPRF    628
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PROGRAM VIPRF       74/74    OPT=1                          FTN 4.5+414        08/16/77  13.11.28

      DATA IF4/6H    F-4/,IF15/7H    F-15/,IF16/7H    F-16/
      DATA IF111/8H    F-111/,IA7D/7H    A-7D/,IA10/7H    A-10/

      DATA ISANDL,IPUFFT,ILAND,ITAKOF/5HSANDL,2HPT,7HLANDING,7HTAKEOFF/
      DATA ITURB/2HTB/

      DATA PI/3.14159265/,IFNISH/6HFINISH/


      DATA N1F4/41/,DX1F4/1.52/
      DATA DE1F4 / 0.0,   -.80, -1.60, -2.80, -4.10, -5.40, -7.30, -9.80,
     1-13.00,-15.00,-20.00,-26.00,-24.40,-22.10,-20.20,-19.10,-18.40,
     2-18.00,-17.80,-17.90,-18.20,-18.90,-20.40,-22.90,-25.30,-26.00,
     3-25.20,-22.60,-19.60,-17.70,-15.60,-14.00,-12.70,-11.30,-10.10,
     4 -9.10, -8.30, -7.50, -6.80, -6.00, -5.30/

      DATA N2F4/41/,DX2F4/1.52/
      DATA DE2F4 / 0.0,  -.90, -2.00, -4.00, -6.50, -9.70,-15.00,-26.00,
     1-22.00,-16.70,-13.70,-11.00,-11.00,-11.30,-11.30,-12.60,-14.20,
     2-16.00,-18.80,-22.40,-30.00,-25.90,-22.00,-19.10,-17.90,-17.30,
     3-17.40,-17.90,-19.80,-25.90,-25.60,-19.00,-14.80,-11.00, -8.75,
     4 -7.00, -5.75, -4.60, -3.80, -3.00,  2.40/

      DATA N1F15/41/,DX1F15/1.375/
      DATA DE1F15/ 0.0,   -.90, -1.75, -2.80, -3.90, -5.00, -6.00, -7.80,
     1 -9.25,-11.10,-13.75,-16.90,-21.20,-25.40,-26.00,-25.60,-23.60,
     2-20.10,-18.30,-16.90,-16.25,-16.10,-16.15,-16.90,-17.60,-18.70,
     3-20.00,-21.75,-25.00,-25.80,-25.70,-21.40,-19.00,-16.80,-15.40,
     4-14.30,-13.00,-12.20,-11.10,-10.30, -9.50/

      DATA N2F15/41/,DX2F15/1.375/
      DATA DE2F15/ 0.0, -1.10, -2.40, -4.25, -6.30, -8.80,-12.40,-18.00,
     1-26.00,-17.00,-13.00,-11.35,-10.90,-10.75,-10.93,-11.10,-11.90,
     2-14.00,-16.50,-23.00,-24.00,-20.30,-19.10,-18.50,-18.40,-18.80,
     3-19.90,-25.30,-26.00,-21.40,-21.40,-19.80,-18.20,-17.20,-16.20,
     4-15.70,-15.00,-14.40,-13.90,-13.40,-13.00/

      DATA N1F16/55/,DX1F16/0.85/
      DATA DE1F16/ 0.0,   -.40, -1.00, -1.40, -2.20, -2.60, -3.40, -4.20,
     1 -5.00, -6.00, -7.40, -8.60,-10.60,-12.30,-14.80,-18.80,-22.60,
     2-26.20,-25.90,-23.10,-21.60,-20.90,-20.15,-19.80,-19.30,-19.00,
     3-18.90,-18.80,-19.60,-18.50,-18.60,-18.75,-19.00,-19.60,-20.20,
     4-21.40,-22.80,-24.40,-25.50,-26.00,-26.20,-26.00,-25.80,-25.30,
     5-23.90,-21.20,-19.30,-17.80,  -.30,-15.10,-14.10,-13.20,-12.30,
     6-11.60,-11.00/

      DATA N2F16/41/,DX2F16/1.1475/
      DATA DE2F16/ 0.0, -1.20, -2.50, -4.30, -6.00, -8.20,-10.90,-15.00,
     1-22.10,-26.00,-20.75,-17.60,-17.15,-17.40,-21.60,-25.10,-25.90,
     2-26.00,-25.90,-25.00,-23.30,-21.90,-21.60,-22.75,-24.50,-25.80,
     3-26.00,-25.80,-24.10,-21.80,-21.60,-21.80,-25.10,-26.00,-21.00,
     4-16.25,-12.75, -9.70, -7.30, -5.40, -3.80/

      DATA N1F111/41/,DX1111/1.7621/
      DATA DE1111/ 1.0,    .20,  -.75, -1.70, -2.60, -3.75, -4.90, -6.00,
     1 -7.80, -9.60,-11.25,-13.60,-16.25,-20.00,-25.80,-26.00,-24.00,
     2-20.50,-18.30,-16.80,-15.60,-14.90,-14.40,-14.35,-14.70,-15.20,
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     3-16.00,-17.60,-19.90,-22.00,-25.85,-26.20,-26.10,-25.20,-20.70,
     4-17.75,-15.80,-14.00,-12.70,-11.50,-10.50/
      DATA N2E111/41/,DX2111/1.7621/
      DATA DE2111/41*0./

      DATA N1A7D/41/,DX1A7D/1.104/
      DATA DE1A7D/ 0.0,  -.80, -1.60, -2.20, -3.00, -3.90, -4.90, -5.80,
     1 -7.00, -8.60,-10.60,-12.90,-16.60,-25.20,-25.80,-20.20,-16.40,
     2-14.10,-13.00,-12.40,-12.00,-11.80,-11.60,-11.65,-11.90,-12.50,
     3-13.75,-15.80,-19.80,-25.20,-26.00,-25.80,-23.00,-16.80,-13.40,
     4-11.00, -9.50, -8.35, -7.70, -6.90, -6.00/

      DATA N2A7D/41/,DX2A7D/1.104/
      DATA DE2A7D/ 0.0, -1.60, -3.70, -6.40, -9.50,-13.00,-21.70,-21.70,
     1-16.00,-11.15,-10.00, -9.50, -9.72,-10.20,-11.20,-12.50,-14.60,
     2-17.70,-22.00,-25.90,-25.70,-22.00,-18.10,-16.00,-14.30,-13.75,
     3-13.40,-13.60,-13.98,-14.25,-15.60,-19.70,-26.00,-20.00,-13.00,
     4-10.30, -7.80, -5.00, -3.30, -1.80,  -.66/

      DATA N1A10/41/,DX1A10/1.315/
      DATA DE1A10/ 0.0, -1.09, -2.38, -4.01, -5.68, -7.54,-10.12,-13.40,
     1-18.06,-25.50,-25.50,-19.17,-15.29,-13.15,-11.70,-10.63, -9.68,
     2 -9.09, -8.71, -8.40, -8.27, -8.04, -8.11, -8.34, -9.68, -9.32,
     3-10.43,-11.57,-14.00,-18.27,-25.80,-20.90,-13.68, -9.24, -6.02,
     4 -3.68, -1.87,  -.32,   .98,  2.26,  3.15/
      DATA N2A10/41/,DX2A10/1.315/
      DATA DE2A10/41*0./


      NRSVAL=43
      FMINPF=100.0 $FMAXPF=100000.0
      FMINHF=10. $FMAXHF=10000.
      FMINGF=5.0 $FMAXGF=10000.
      HMAX=50000.0 $RSMAX=30.0 $WFMAX=5000.0
      YPF=0.010 $IPLOT=0
      BBLFLO=0.3 $BBLFHI=0.5 $XXLFLO=2.0 $XXLFHI=0.5
      FMFLO=40.0 $FMFHI=250.0 $BMFLO=0.3 $BMFHI=0.3
      XMFLO=2.5 $XMFHI=0.4
      BHFLO=0.3 $BHFHI=0.3 $XXHFLO=2.0 $XXHFHI=0.5
      AHFLO=0.8 $AHFHI=1.30  $APFHI=1.0 $ALFLO=1.0 $ALFHI=1.0
      AMFLO=1.0 $AMFHI=1.0
      BL2FLO=0.2 $BL2FHI=0.2 $XL2FLO=1.80 $XL2FHI=0.555
      AL2FLO=1.0 $AL2FHI=2.0
      AMFMAX=-144.0 $AHFMAX=-121.0
      C1AXLO=2.0 $C1AXHI=0.5 $C1ABLO=0.2 $C1ABHI=0.2 $C1AALO=1.0
      C1AAHI=1.0 $C1AFN=25.0 $C1AMAX=12.0
      C2AXLO=1.8 $C2AXHI=0.5 $C2ABLO=0.2 $C2ABHI=0.2 $C2AALO=1.0
      C2AAHI=1.7 $C2AFN=43.0 $C2AMAX=13.0
      C2BXLO=2.0 $C2BXHI=0.50 $C2BBLO=0.200 $C2BBHI=0.300 $C2BALO=1.0
      C2BAHI=1.90 $C2BFN=40.0 $C2BMAX=14.0
      C5BLO=0.1 $C5BHI=0.1 $C5XLO=1.42 $C5XHI=1./1.42 $C5ALO=0.50
      C5AHI=1.4 $C5FN=200.0 $C5MAX=33.0
      BUFXLO=1.27 $BUFXHI=0.583 $BUFBHI=0.200 $BUFFZL=24.0 $BUFFZH=60.0
      BUFALO=0. $BUFAHI=1.0 $BUFDEL=5.0

      TAKBLO=0.3 $TAKBHI=0.4 $TAKXLO=4.0 $TAKXHI=0.50 $TAKALO=0.4
      TAKAHI=1.0 $TAKMAX=10.0
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PROGRAM VIPRF       74/74    OPT=1                          FTN 4.5+414        08/16/77  13.11.28

            ALNBLO=0.3 $ALNBHI=0.3 $ALNXLO=2.0 $ALNXHI=0.5 $ALNALO=0.4
            ALNAHT=1.60 $ALNMAX=12.0
            TBBHI=0.3 $TBAHI=1.0 $TBFC=5.0 $TBREF=12.0

            NC3=10
            C3APHI=0.2 $C3AXLO=2.0 $C3AALO=2.0 $C3AFN=25.0 $C3BFN=35.0

            CALL CCMPRS $CALL YAXANG(0.) $CALL YINTAX
            CALL BASALF("L/CSTD") $CALL MIXALF("STANDARD") $CALL MARKER(1)
            HITE=0.140 $HITE1=5.*HITE/7.
            XCYCLE=2.0 $YAXIS=8.0 $TICLEN=0.026

      C   ************************
      C   *                      *
      C   *    READ INPUT DATA   *
      C   *                      *
      C   ************************

          1 READ(5,15) (IPLANE(I),I=1,3),JFLITE,INOPLT
            IF(EOF(5).NE.0) GO TO 890
         15 FORMAT(8A10)

         31 I=10H**********0 $PRINT 25,I,I,I,I,I,I,I
         25 FORMAT(1H1,19X,*INPUT DATA CARDS*//63X,*COLUMN NUMBER*/
           138X,*1*,9X,*2*,9X,*3*,9X,*4*,9X,*5*,9X,*6*,9X,*7*,9X,*8*/
           229X,10H1********0,7A10/)
            PRINT 33,(IPLANE(I),I=1,3),JFLITE,INOPLT
         33 FORMAT(1H0,28X,*DESCRIPTION CARD*/29X,8A10)

            READ 15,ILINE2
            PRINT 36,ILINE2
         36 FORMAT(1H0,28X,*ALTITUDE-MACH NO. CARD*/29X,8A10)
            DECODE(80,37,ILINE2) (ALT(I),AMAKNO(I),I=1,6)
         37 FORMAT(6(F9.2,F5.2))

            READ 15,ILINE2
            PRINT 38,ILINE2
         38 FORMAT(1H0,28X,*AIRCRAFT PARAMETERS CARD*/29X,8A10)
            DECODE(80,39,ILINE2) XE,2S,WE,DF,T,FCCAT1,FCCAT2,MATERL,CATGRY
         39 FORMAT(7F10.3,A1,A2)


            I=IPLANE(1)
            IF(I.EQ.IF4) GO TO 20
            IF(I.EQ.IF15) GO TO 26
            IF(I.EQ.IF16) GO TO 40
            IF(I.EQ.IF111) GO TO 43
            IF(I.EQ.IA7D) GO TO 45
            IF(I.EQ.IA10) GO TO 48

            CALL READCDS(0.,0.,0.,0.,0.,0.,0.,0.,0,0.,0.,0,0.,0.,0,I,IERROR)
            GO TO 47

         20 CALL READCDS(14.3,-122.0,18.94,-129.0,35.0,32.3,35.3,1.0,
           1N1F4,DX1F4,DB1F4,N2F4,DX2F4,D32F4,1,IF4,IERROR)
            GO TO 47
```

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PROGRAM VIPRF       74/74    OPT=1                        FTN 4.5+414          08/16/77  13.11.28

   23 CALL READCDS(8.5,-127.0,27.8,-131.0,35.0,39.1,40.2,1.0,
     2N1F15,DX1F15,DB1F15,N2F15,DX2F15,DB2F15,1,IF15,IERROR)
      GO TO 47
   40 CALL READCDS(12.9,-131.0,32.5,-133.0,35.0,27.1,29.5,1.0,
     2N1F16,DX1F16,DB1F16,N2F16,DX2F16,DB2F16,1,IF16,IERROR)
      GO TO 47
   43 CALL READCDS(8.5,-134.0,0.00, 0.0,35.0,38.1,47.1,1.0,
     1N1F111,DX1111,DB1111,N2F111,DX2111,DB2111,1,IF111,IERROR)
      GO TO 47
   45 CALL READCDS(15.2,-129.0,23.0,-140.0,35.0,20.5,25.4,1.0,
     2N1A7D,DX1A7D,DB1A7D,N2A7D,DX2A7D,DB2A7D,1,IA7D,IERROR)
      GO TO 47
   49 CALL READCDS(9.04,-131.0, 0.0, 0.0,35.0,0.00, 4.0,1.0,
     1N1A10,DX1A10,DB1A10,N2A10,DX2A10,DB2A10,1,IA10,IERROR)


   47 IF(IERROR.EQ.0) GO TO 27
      IF(IERROR.EQ.1) GO TO 1
      IF(IERROR.EQ.2) GO TO 4
      IF(IERROR.EQ.3.OR.IERROR.EQ.4) GO TO 41

    4 IPLANE(1)=ILINE2(1) $IPLANE(2)=ILINE2(2)
      IPLANE(3)=ILINE2(3) $JFLITE=ILINE2(4)
      INOPLT=ILINE2(5)
      GO TO 31

   41 DO 42 I=1,5
   42 IHOLD(I)=ILINE2(I)

C     *                                        *
C     * CHECK VALIDITY OF INPUT DATA VALUES    *
C     *                                        *
C     ******************************************

   27 M=0
      IF(JFLITE.EQ.ISANDL.OR.JFLITE.EQ.IBUFET.OR.JFLITE.EQ.ITAKOF
     1.OR.JFLITE.EQ.ILAND.OR.JFLITE.EQ.ITURB) GO TO 9
      M=1 $PRINT 29,JFLITE,ISANDL,IBUFET,ITAKOF,ILAND,ITURB
   29 FORMAT(1H-, A10,* WAS READ FOR THE FLIGHT CONDITION,NOT*,A10,*OR*,
     1A10,*OR*,A10,*OR*,A10,*OR*,A10/* FOR "STRAIGHT-AND-LEVEL","BUFFET-
     2TURN","TAKE-OFF","LANDING" AND "LOW-FREQ. ATMOSPHERIC TURBULENCE",
     3RESPECTIVELY.*)

    9 IF(XE.GT.0.) GO TO 10
      M=1 $II=10HDOWN-STREA  $J=10HM AERO.DST $PRINT 5,II,J,XE
      II=3H>0. $PRINT 8,II,IBLANK

   10 IF(RS.GE.0.) GO TO 14
      M=1 $II=10H DISTANCE  $J=9HFROM SKIN $PRINT 5,II,J,RS
      II=10H>0. OR =0. $PRINT 8,II,IBLANK

   14 IF(WE.GE.0.) GO TO 11
      M=1 $II=10H  EQUIPMEN $J=8HT WEIGHT $PRINT 5,II,J,WE
      II=10H>0. OR =0. $PRINT 8,II,IBLANK

   11 IF(DE.GT.0.) GO TO 18
```

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PROGRAM VIPRF       74/74    OPT=1                        FTN 4.5+414         08/16/77  13.11.28

      M=1 $II=10H FUSELAGE  $J=8HDIAMETER $PRINT 5,II,J,DF
      II=3H>0. $PRINT 8,II,IBLANK
      GO TO 19

   14 X1=DF/2. $IF(RS.LE.X1) GO TO 19
      M=1 $PRINT 16,RS,X1
   16 FORMAT(1H-,*THE SPECIFIED DISTANCE FROM THE SKIN *,F7.2,* EXCEEDS
     1ONE-HALF THE FUSELAGE DIAMETER *,F7.2)
      II=10HFUSELAGE D $J=6HIA./2. $PRINT 8,II,J

   19 IF(T.GT.0.) GO TO 23
      M=1 $II=10H   SKIN TH $J=7HICKNESS $PRINT 5,II,J,T
      II=3H>0. $PRINT 8,II,IBLANK

   23 IF(CATGRY.EQ.C1B) GO TO 76
      IF(FCCAT1.GE.0.) GO TO 74
      M=1 $II=10HCATEGORY C $J=10HENTER FRQ. $PRINT 5,II,J,FCCAT1
      II=10H>0. CR =0. $PRINT 8,II,IBLANK

   74 IF(FCCAT2.GE.0.) GO TO 76
      M=1 $II=10HCATEGORY 3 $J=10HA OR 3B FC $PRINT 5,II,J,FCCAT2
      II=10H>0. CR =0. $PRINT 8,II,IBLANK

   76 IF(MATERL.EQ.ISTEEL.OR.MATERL.EQ.ITITAN.OR.MATERL.EQ.IALUM
     1.OR.MATERL.EQ.IMAG) GO TO 50
      M=1 $PRINT 24,MATERL
   24 FORMAT(1H-,*THE LETTER SPECIFIED FOR THE AIRCRAFT MATERIAL WAS *,
     1A1/* IT MUST BE S,T,A OR M FOR STEEL,TITANIUM,ALUMINUM AND MAGNESI
     2UM,RESPECTIVELY.*)

   50 IF(CATGRY.EQ.C1A.OR.CATGRY.EQ.C1B.OR.CATGRY.EQ.C2A.OR.CATGRY.EQ.
     1C2B.OR.CATGRY.EQ.C3A.OR.CATGRY.EQ.C3B.OR.CATGRY.EQ.C4A.OR.
     2CATGRY.EQ.C4B.OR.CATGRY.EQ.C5.OR.CATGRY.EQ.C6) GO TO 54
      M=1 $PRINT 52,CATGRY,C1A,C1B,C2A,C2B,C3A,C3B,C4A,C4B,C5,C6
   52 FORMAT(1H-,A3,* WAS SPECIFIED FOR THE EQUIPMENT-MOUNTING CATEGORY.
     1*/* THE PROGRAM EXPECTS SPECIFICATIONS FOR CATEGORIES ONLY AS FOLL
     2OWS:*10(1X,A3)/* THE PROGRAM PROCEEDS TO THE NEXT PROBLEM FOR ANAL
     3YSIS.*)
   54 IF(FN.GT.0.) GO TO 60
      M=1 $II=10H1ST MODE F $J=8HREQUENCY $PRINT 5,II,J,FN
      II=3H>0. $PRINT 8,II,IBLANK

   60 IF(XLFMAX.LT.0.) GO TO 56
      M=1 $II=10H MAX.VALUE $J=8H OF L(F) $PRINT 5,II,J,XLFMAX
      II=3H<0. $PRINT 8,II,IBLANK

   56 IF(F2N.GE.0.) GO TO 64
      M=1 $II=10H2ND MODE F $J=8HREQUENCY $PRINT 5,II,J,F2N
      II=10H>0. OR =0. $PRINT 8,II,IBLANK

   64 IF(XL2FMX.LE.0.) GO TO 58
      M=1 $II=10H MAX.VALUE $J=9H OF L2(F) $PRINT 5,II,J,XL2FMX
      II=10H<0. CR =0. $PRINT 8,II,IBLANK

   58 IF(BUFMAX.GE.0.) GO TO 62
      M=1 $II=10HMAX.OF BUF $J=10H.TURN S(F) $PRINT 5,II,J,BUFMAX
      II=10H>0. CR =0. $PRINT 8,II,IBLANK
```

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PROGRAM VIPRF      74/74    OPT=1                    FTN 4.5+414        08/16/77   13.11.28

   62 IF(XBT.GE.0.) GO TO 66
      M=1 $II=10HBUFFET-TUR $J=10HN DISTANCE $PRINT 5,II,J,XBT
      II=10H>0. OR =0. $PRINT 8,II,IBLANK

   66 IF(XTL.GE.0.) GO TO 68
      M=1 $II=10HTAKEOFF-LA $J=10HNDING DIST $PRINT 5,II,J,XTL
      II=10H>0. OR =0. $PRINT 8,II,IBLANK

   68 IF(FCMOVE.GE.0.) GO TO 70
      M=1 $II=10HMULT.CONST $J=5HANT K $PRINT 5,II,J,FCMOVE
      II=3H>0. $PRINT 8,II,IBLANK

   70 IF(NMODE1.GT.0.) GO TO 21
      M=1 $II=10HNO.DB VAL. $J=10H1ST B.MODE $X1=NMODE1 $PRINT 5,II,J,X1
      II=3H>0. $PRINT 8,II,IBLANK

   21 IF(DXMOD1.GT.0.) GO TO 30
      M=1 $II=10HXE DIST.BE $J=9HT.DB VALS $PRINT 5,II,J,DXMOD1
      II=3H>0. $PRINT 8,II,IBLANK

   30 IF(F2N.EQ.0.) GO TO 35
      IF(NMODE2.GT.0) GO TO 32
      M=1 $II=10HNO.DB VAL. $J=10H2ND B.MODE $X1=NMODE2 $PRINT 5,II,J,X1
      II=3H>0. $PRINT 8,II,IBLANK

   32 IF(DXMOD2.GT.0.) GO TO 35
      M=1 $II=10HXE DIST.BE $J=10HT.DB VALS. $PRINT 5,II,J,DXMOD2
      II=3H>0. $PRINT 8,II,IBLANK


   35 DO 1000 I=1,6
      IF(AMAKNO(I).EQ.0.) GO TO 1000


      H=ALT(I) $IF(H.GE.0..AND.H.LE.HMAX) GO TO 28
      M=1 $II=10H      ALTI $J=4HTUDE $PRINT 5,II,J,H
      II=9H   > OR = $J=9H   < OR = $X1=0. $PRINT 6,II,X,J,HMAX
    6 FORMAT(* THE PROGRAM ASSUMES THAT IT WILL BE *,A10,G12.5,* AND *,
     1A10,F11.2)
      GO TO 7

   28 XMAKNO=AMAKNO(I)
      IF(JFLITE.NE.ITAKOF.AND.JFLITE.NE.ILAND) GO TO 7
      IF(XMAKNO.EQ.0.93.AND.H.EQ.2000.0) GO TO 78
      PRINT 2,H,XMAKNO
    2 FORMAT(//////////1H1/*THE FOLLOWING VALUES,READ FOR ALTITUDE(H) AND
     1 MACH NUMBER(M),WERE INCORRECTLY SPECIFIED ON THE ALTITUDE-MACH NO
     2. CARD:*/35X,*H=*,F10.1/35X,*M*,F10.3//* THEY WERE SET EQUAL TO TH
     3E CORRECT VALUES,H=2000.0 AND M=0.93, WHICH ALWAYS MUST BE SPECIFI
     4ED*/* WHEN THE FLIGHT PHASE IS TAKE-OFF AND LANDING.*)
      XMAKNO=0.93 $H=2000.0 $GO TO 78

    7 IF(XMAKNO.GT.0.) GO TO 78
      M=1 $II=10H      MACH $J=4H NO. $PRINT 5,II,J,XMAKNO
    5 FORMAT(1H-,*THE VALUE SPECIFIED FOR *,2A10,* IS *,G12.5)
      II=3H>0. $PRINT 8,II,IBLANK
```

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   9 FORMAT(* THE PROGRAM ASSUMES THAT IT WILL BE *,2A10)


  78 IF(M.EQ.1) GO TO 1000

     IF(FCMOVE.EQ.0.) FCMOVE=1.0

     ICK=0 $IFLITE=ISANDL

   3 DO 17 II=1,7
     ILINE1(II)=1H $ILINE2(II)=1H
  17 ITITL1(II)=1H

     ILINE1(1)=10H TO EQUIPM $ILINE1(2)=10HENT LOCATI $ILINE1(3)=2HON
     X=XE $IX=1HE $IPHASE=5H (E)$ $IF(IFLITE.EQ.ISANDL) GO TO 34
     IF(IFLITE.NE.IFUFET) GO TO 12
     ILINE1(1)=10H TO THE CH $ILINE1(2)=10HORD CENTER
     ILINE1(3)=10H OF THE WI $ILINE1(4)=2HNG
     X=XPT $IX=2HBT $IPHASE=6H (PT)$ $GO TO 34
  12 IF(IFLITE.NE.ITAKOF) GO TO 13
     ILINE1(1)=10H TO THE LA $ILINE1(2)=10HNDING GEAR
     X=XTL $IX=1HT $IPHASE=5H (T)$ $IFN=1HN $GO TO 34

  13 IF(IFLITE.NE.ILAND) GO TO 22
     X=XTL $IX=1HL $IPHASE=5H (L)$ $IFN=2H2N $GO TO 34

  22 X=XE  $IX=2HTE $IPHASE=6H (TE)$ $IFN=1HN

  34 II=H/500.+1 $X1=500.
     IF(H.LE.10000.) GO TO 44
     II=H/1000.+11 $X1=1000.
  44 V=VISCOS(II) $C=SOUND(II) $R=AVDENS(II)
     X2=AMOD(H,X1) $IF(X2.EQ.0.) GO TO 45
     II=II+1 $X3=X2/X1
     R=R+(AVDENS(II)-R)*X3
     C=C+(SOUND(II)-C)*X3
     V=V+(VISCOS(II)-V)*X3

  45 RNORM=R/AVDENS(1) $VNORM=V/VISCOS(1) $U=XMAKNO*C $QSQ=R*U*U/2.
     QSQ=QSQ*QSQ $REY=U*XE/VISCOS(1)
     DELTAZ=6.5E7/REX $DELTAZ=1.0E-2*XE*(1.0+DELTAZ*DELTAZ)**0.10
     DELTAB=DELTAZ*(RNORM**0.7)

     FZPF=0.70*U/DELTAB

     BPF=1.745 $IF(FZPF.LE.700.0) GO TO 90
     BPF=0.375 $IF(FZPF.GE.19900.0) GO TO 90
     CALL TERPLIN(FZPF,700.0,300.0,X1,0,BPF,BFZPF,NBFZPF)

  90 X1=.007/(1.0+0.14*XMAKNO*XMAKNO) $PFM=X1*X1*QSQ*DELTAB/U
     PFMDB=0.41771E-5 $PFMDB=10.0*ALOG10(PFM/(PFMDB*PFMDB))


     IF(MATERL.NE.IALUM) GO TO 92
     WS=14.5*T $J=10H  ALUMINUM
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      GO TO 100
   92 IF(MATERL.NE.ITITAN) GO TO 94
      WS=24.0*T $J=10H   TITANIUM
      GO TO 100
   94 IF(MATERL.NE.ISTEEL) GO TO 96
      WS=41.0*T $J=10H     STEEL
      GO TO 100
   96 WS=9.17*T $J=10H MAGNESIUM


  100 PRINT 246
      PRINT 353,IPLANE,IFLITE
      PRINT 205,H,XMAKNO,X,IX,IX,(ILINE1(II),II=1,5)
      II=1H $IF(CATGRY.EQ.C1A) II=1H*
      PRINT 210,RS,WE,T,J,WS,CATGRY,DF
      PRINT 220
      PRINT 225,R,AVDENS(1),PNORM,V,VISCOS(1),VNORM,C
      PRINT 230
      PRINT 235,U,QSQ,REY,DELTAZ,DELTAB
  205 FORMAT(1H-,19X,*H=*,F12.1,6X,*ALTITUDE(FT.)*/
     *20X,*M=*,F12.2,6X,*MACH NO.*/
     219X,*X =*,F12.2,6X,A2,* DISTANCE FROM THE LEADING EDGE OF THE */
     320X,A2,18X,*FUSELAGE AERODYNAMIC PROFILE(FT.) *,5A10)
  210 FORMAT(19X,*R =*,F12.2,6X,*DISTANCE FROM SKIN(IN.)*/20X,*S*/
     119X,*W =*,F12.2,6X,*EQUIPMENT WEIGHT(LBS.)*/20X,*E*/
     220X,*T=*,F12.4,6X,*THICKNESS OF SKIN MATERIAL(IN.)*/
     313X,*MATERIAL=*,3X,A10,5X,*TYPE SKIN MATERIAL*/
     472X,*2*/19X,*W =*,F12.3,6X,*DENSITY OF SKIN MATERIAL,LBS./FT.(CALC
     5ULATED)*/20X,*S*/
     613X,*CATEGORY=*,9X,A2,7X,*EQUIPMENT MOUNTING CATEGORY*/
     719X,*D =*,F12.1,6X,*DIAMETER OF FUSELAGE(IN.)*/20X,*F*//)
  220 FORMAT(* VALUES SELECTED FROM ATMOSPHERIC TABLE*)
  225 FORMAT(
     *19X,*P =*,F12.6,6X,*MEAN AIR DENSITY AT ALTITUDE H(SLUG/CU.FT.)*/
     *19X,*P =*,F12.6,6X,*MEAN AIR DENSITY AT ZERO ALTITUDE(SLUG/CU.FT.)
     **/20X,*0*/
     *17X,*P/P =*,F12.5,6X,*NORMALIZED MEAN AIR DENSITY*/20X,*0*//
     *19X,*V =*,F12.7,6X,*KINEMATIC VISCOSITY AT ALTITUDE H(FT.SQ./SEC.)
     **/
     *19X,*V =*,F12.7,6X,*KINEMATIC VISCOSITY AT ZERO ALTITUDE(FT.SQ./SE
     *C.)*/20X,*0*/
     *17X,*V/V =*,F12.3,6X,*NORMALIZED KINEMATIC VISCOSITY*/20X,*0*//
     *20X,*C=*,F12.2,6X,*SPEED OF SOUND AT ALTITUDE H(FT./SEC.)*///)
  230 FORMAT(* VALUES CALCULATED FOR AERODYNAMIC PARAMETERS*)
  235 FORMAT(
     119X,*U =*,F12.2,6X,*FREE STREAM VELOCITY(FT.SEC.)*/
     220X,*2*,39X,*2*/19X,*Q =*,E12.5,6X,*DYNAMIC PRESSURE(PSF )*/
     *18X,*RE =*,F12.5,6X,*REYNOLDS NUMBER AT DISTANCE X*/20X,*X*/
     *15X,*DELTA =*,F12.4,6X,*BOUNDARY LAYER THICKNESS AT ZERO ALTITUDE(
     *FT.)*/20X,*0*/
     *15X,*DELTA =*,F12.4,6X,*BOUNDARY LAYER THICKNESS AT ALTITUDE H(FT.
     7)*/20X,*B*)



      PRINT 246 $PRINT 353,IPLANE,IFLITE
      PRINT 240
```

PROGRAM VIPRF 74/74 OPT=1 FTN 4.5+414 08/16/77 13.11.28

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  243 FORMAT(1H-,*PARAMETERS OF THE BOUNDARY LAYER FUNCTION FOR F(F)*)
      PRINT 245,PFM,PFMDB,RPF,XPF,FZPF,APFHI
  245 FORMAT(54X,*2*/16X,*P (F)=*,F12.4,6X,*MAXIMUM VALUE OF PSD,PSF /HZ
     1.*/17X,*M*/
     279X,*-6 2*,4X,*2*/16X,*P (F)=*,F12.2,6X,*MAXIMUM VALUE OF PSD,DB.
     3RE.(0.41771X10  )  PSF/HZ.*/17X,*M*/
     419X,*B'=*,F12.3,6X,*SLOPE FACTOR,HIGH FREQ.ROLL-OFF*/
     519X,*X'=*,F12.3,6X,*NORMALIZING FREQ.RATIO,HIGH-FREQ.ROLL-OFF*/
     619X,*F'=*,F12.1,6X,*LOCATOR FREQUENCY,HIGH FREQ.ROLL-OFF(HZ.)*/
     720X,*C*/
     815X,*ALPHA'=*,F12.3,6X,*FORM FACTOR,HIGH FREQ.ROLL-OFF*)

      ITITL1(1)=10H(S AND L F  $ITITL1(2)=7HLIGHT)$
      XMFMAX=AMFMAX $XHFMAX=AHFMAX



      IF(IFLITE.EQ.ISANDL) GO TO 280
      IF(IFLITE.NE.IBUFFT) GO TO 250

C     *************************
C     *                       *
C     * BUFFET-TURN PHASE     *
C     *                       *
C     *************************
      ILINE1(1)=10HCENTER FRE $ILINE1(2)=10HQUENCY OF
      ILINE1(3)=10HSPECIAL TR $ILINE1(4)=10HANSFER FUN
      ILINE1(5)=5HCTION
      ITITL1(1)=10H(BUFFET TU $ITITL1(2)=10HRN PHASE)$

      SXLO=BUFXLO $SXHI=BUFXHI $SBHI=BUFBHI $M=3HCRT
      SALO=BUFALC $SAHI=BUFAHI $SDELTA=BUFDEL $SFZLC=BUFFZL

      D=ABS(X-XF)
      SBTED=DBBVAL(NDDB) $IF(D.GT.(NDDB-1)) GO TO 239

      CALL TERPLIN(D,DELDDB,0.,X1,1,SBTED,DDBVAL,NDDB)

  239 SBTED=BUFMAX+SBTED $IF(SBTED.EQ.SDELTA) SBTED=1.01*SDELTA
      IF(SBTED.GT.SDELTA) GO TO 247

      HILO(1)=PI $SIGN(1)=-1.0 $SXHI=0.167 $SAHI=2.0 $SFZHI=30.0
      SPEAK=SDELTA
      FCS=FCMOVE*SXHI*SFZHI $SFZHI=FCS/SXHI $FRQ=SXLO*SFZLO
      CALL BETA(SBHI,SDELTA,SBTED,SXHI,SAHI,FRQ,SFZHI,SIGN(1),HILO(1))
      GO TO 253

  247 HILO(1)=0. $SIGN(1)=1.0 $FCS=SXLO*SFZLC $SPEAK=SBTED
      SFZHI=FCMOVE*FCS/SXHI $FRQ=FMINGF
      CALL BETA(SBLC,SBTED,SDELTA,SXLO,SALO,FRQ,SFZLO,SIGN(1),HILO(1))
      GO TO 253

C     *************************
C     *                       *
C     * TAKE-OFF PHASE        *
C     *                       *
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C     ************************                                          VIPRF   1142
  250 IF(IFLITE.NE.ITAKOF) GO TO 252                                    VIPRF   1143
      ILINE1(1)=10HFIRST FUSE $ILINE1(2)=10HLAGE BENDI                  VIPRF   1144
      ILINE1(3)=10HNG MODE,VE $ILINE1(4)=10HRTICAL(HZ)                  VIPRF   1145
      ITITL1(1)=10H(TAKEOFF P $ITITL1(2)=6HHASE)$                       VIPRF   1146
                                                                        VIPRF   1147
      XMFMAX=-149.0 $XHFMAX=-129.0                                      VIPRF   1148
      SXLO=TAKXLO $SXHI=TAKXHI $SBLO=TAKBLO $SBHI=TAKBHI                VIPRF   1149
      SALO=TAKALO $SAHI=TAKAHI $SPEAK=TAKMAX $M=2HCT                    VIPRF   1150
                                                                        VIPRF   1151
      SEZLO=EN/SXLO                                                     VIPRF   1152
      SEZHI=FCMOVE*EN/SXHI $FCS=EN                                      VIPRF   1153
                                                                        VIPRF   1154
      GO TO 253                                                         VIPRF   1155
                                                                        VIPRF   1156
C     ************************                                          VIPRF   1157
C     *                      *                                          VIPRF   1158
C     * LANDING PHASE        *                                          VIPRF   1159
C     *                      *                                          VIPRF   1160
C     ************************                                          VIPRF   1161
  252 IF(IFLITE.NE.ILAND) GO TO 256                                     VIPRF   1162
      ILINE1(1)=10HSECOND FUS $ILINE1(2)=10HELAGE BEND                  VIPRF   1163
      ILINE1(3)=10HING MODE,V $ILINE1(4)=10HERTICAL(HZ)                 VIPRF   1164
                                                                        VIPRF   1165
      ITITL1(1)=10H(LANDING P $ITITL1(2)=6HHASE)$                       VIPRF   1166
                                                                        VIPRF   1167
      XMFMAX=-152.0 $XHFMAX=-135.0                                      VIPRF   1168
                                                                        VIPRF   1169
      SXLO=ALNXLO $SXHI=ALNXHI $SBLO=ALNBLO $SBHI=ALNBHI                VIPRF   1170
      SALO=ALNALO $SAHI=ALNAHI $SPEAK=ALNMAX $M=2HCL                    VIPRF   1171
      SEZLO=E2N/SXLO $FCS=E2N                                           VIPRF   1172
      SEZHI=FCMOVE*E2N/SXHI                                             VIPRF   1173
      GO TO 253                                                         VIPRF   1174
                                                                        VIPRF   1175
                                                                        VIPRF   1176
C     ************************                                          VIPRF   1177
C     *                      *                                          VIPRF   1178
C     * TURBULENCE PHASE     *                                          VIPRF   1179
C     *                      *                                          VIPRF   1180
C     ************************                                          VIPRF   1181
  256 ILINE1(1)=10HCENTER FRE $ILINE1(2)=10HQ. OF S(F)                  VIPRF   1182
      ILINE1(3)=10HFOR LF ATM $ILINE1(4)=10HOS.TURBULE                  VIPRF   1183
      ILINE1(5)=10HNCE(HF ROL $ILINE1(6)=10HL-OFF ONLY $ILINE1(7)=1H)   VIPRF   1184
      ITITL1(1)=10H(LOW FREQ. $ITITL1(2)=10HATMOS.TURB                  VIPRF   1185
      ITITL1(3)=10HULENCE PHA $ITITL1(4)=4HSE)$                         VIPRF   1186
                                                                        VIPRF   1187
      SBHI=TBBHI $SAHI=TBAHI $SEZHI=EN $M=3HCTB                         VIPRF   1188
      FCS=FCMOVE*TBFC $SXHI=FCS/SEZHI                                   VIPRF   1189
                                                                        VIPRF   1190
      FRQ=SEZHI $X1=FRQ/SEZHI                                           VIPRF   1191
      X2=PI-ATAN2(2.0*SBHI*(X1**SAHI),1.0-X1*X1)                        VIPRF   1192
      X3=PI-ATAN2(2.0*SBHI*(SXHI**SAHI),1.0-SXHI*SXHI)                  VIPRF   1193
      SPEAK=TBREF-20.0*ALOG10(X2/X3)                                    VIPRF   1194
                                                                        VIPRF   1195
                                                                        VIPRF   1196
  253 PRINT 251,IX                                                      VIPRF   1197
  251 FORMAT(1H-,*PARAMETERS OF THE SPECIAL FUNCTION FOR S (F)*/41X,A2) VIPRF   1198
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      II=5HS (F) $J=1HM $PRINT 352,II,SPEAK,II,IPLANE(1),IX,J,IX
  352 FORMAT(17X,A5,*=*,F12.2,5X,*MAXIMUM VALUE OF *,A5,*-DB.,FOR*,
     1A10,*TYPE AIRCRAFT*/18X,A2,1X,A1,37X,A2)

      IF(IFLITE.EQ.IBUFET.AND.SPTED.LT.SDELTA) GO TO 257

      PRINT 380,SBLO,SBHI,SXLO,SXHI,SFZLO,SFZHI
      PRINT 441,FCS,(ILINE1(J),J=1,7),M
      PRINT 425,SALO,SAHI
      IF(IFLITE.EQ.IBUFET) PRINT 254,SDELTA,FMINGF,BUFMAX,D,XE
  254 FORMAT(1H-,15X,*DELTA =*,F12.2,6X,*VALUE OF S (F) AT*,
     1F6.1,* HZ.*/21X,*D*,29X,*BT*/
     287X,*2*,12X,*-4*,9X,*2 2*/16X,*S (F)'=*,F12.1,6X,*MAXIMUM VALUE OF
     3 S (F) (WHEN D=0.)-DB.RE 1.0 G /HZ./RE.(2X10  DYNES-CM.) /HZ.*/
     417X,*BT M*,38X,*BT M*//
     521X,*D=*,F12.2,6X,*DIFFERENCE,X -X*/53X,*PT E*/
     620X,*X =*,F12.2,6X,*E DISTANCE FROM THE LEADING EDGE OF THE FUSELA
     7GE*/21X,*E*,19X,*AERODYNAMIC PROFILE(FT.) TO THE CENTER OF THE WIN
     8G CHORD*)
      GO TO 280

  257 PRINT 255,SBHI,SXHI,SFZHI,SAHI,FCS
  255 FORMAT(20X,*B'=*,F12.3,6X,*SLOPE FACTOR,HIGH-FREQ.ROLL-OFF*/
     120X,*X'=*,F12.3,6X,*NORMALIZING FREQ.RATIO,HIGH-FREQ.ROLL-OFF*/
     220X,*F'=*,F12.2,6X,*LOCATOR FREQ.,HIGH-FREQ.ROLL-OFF*/21X,*0*/
     316X,*ALPHA'=*,F12.3,6X,*FORM FACTOR,HIGH-FREQ.ROLL-OFF*/
     420X,*F =*,F12.2,6X,*CENTER FREQ. OF TRANSFER FUNCTION(HZ.)*/
     521X,*C*)
      PRINT 254,SDELTA,FMINGF,SDELTA,BUFMAX,D,XE
      PRINT 260,SPTED,D,SDELTA,SPTED,FRQ
  260 FORMAT(1H-,
     120X,*NOTE:SINCE S (F)=*,G12.5,* CORRESPONDING TO D=*,G12.5/
     232X        /25X,*IS LESS THAN DELTA=*,G12.5* ONLY THE HIGH-FREQ.ROL
     3L-OFF PORTION */25X,*OF THE S(F) TRANSFER FUNCTION IS USED IN CALC
     4ULATING F (F).*/79X,*B1*/25X,*(S(F)=*,G12.5,* AT F=X*,4H*F =,G12.5
     5* HZ.)*/52X,*0*)

C     ************************
C     *                      *
C     *     H(F)             *
C     *                      *
C     ************************
  280 XX=RS $IF(RS.GT.RSMAX) XX=RSMAX
      CALL TERPLIN(XX,X1,RSVALS(1),RSVALS,1,DELRS,DBRS,NRSVAL)
      CALL TERPLIN(XX,X1,RSVALS(1),RSVALS,1,FZHFHI,FPRIHF,NRSVAL)
      FRQ=FZHFHI


      AK=1.0 $IF(WE.LE.2.5) GO TO 320
      AK=0.55 $IF(WE.GE.200.0) GO TO 320

      DO 310 J=1,14
      II=J $X1=WEK(J)
      IF(WE.LE.X1) GO TO 315
  310 CONTINUE
  315 AK=VALK(II)+(WE-X1)*(VALK(II-1)-VALK(II))/(WEK(II-1)-X1)
```

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PROGRAM VIPRF       74/74    OPT=1                       FTN 4.5+414          08/16/77  13.11.28

         320 FZHFHI=AK*FZHFHI
             FZHFLO=275.0*T/0.036 $IF(CATGRY.EQ.C6) FZHFLO=350.0*T/0.036


             XHFLO=XXHFLO $XHFHI=XXHFHI
             X1=XHFLO*FZHFLO $X2=XHFHI*FZHFHI $IF(X2.GE.X1) GO TO 325
             CONST=0.025

         323 XHFLO=XHFLO-CONST*XHFLO $XHFHI=XHFHI+CONST*XHFHI
             IF(XHFLO.GT.1.0) GO TO 321
             XHFLO=1.0 $XHFHI=FZHFLO/FZHFHI $GO TO 325

         321 IF(XHFHI.LT.1.0) GO TO 322
             XHFHI=1.0 $XHFLO=FZHFHI/FZHFLO $GO TO 325

         322 X1=XHFLO*FZHFLO $X2=XHFHI*FZHFHI $IF(X2.LT.X1) GO TO 323
             XHFLO=X2/FZHFLO


         325 DELWE=0. $IF(WE.LE.10.0) GO TO 340
             IF(CATGRY.NE.C1B.AND.CATGRY.NE.C6) GO TO 340
             IF(WE.GE.100.) GO TO 330
             CALL TERPLIN(WE,DWE100,10.,X1,0,DELWE,WE100,NWE100)
             GO TO 340
         330 IF(WE.GE.1000.) GO TO 335
             CALL TERPLIN(WE,DWE1K,100.,X1,0,DELWE,WE1000,NWE1K)
             GO TO 340
         335 DELWE=WE5000(9) $IF(WE.GT.WEMAX) GO TO 340
             CALL TERPLIN(WE,DWE5K,1000.0,X1,0,DELWE,WE5000,NWE5K)


         340 DELWS=0. $IF(WS.LE.0.5) GO TO 350
             DELWS=20.*ALOG10(0.5/WS)


         350 IF(CATGRY.EQ.C6) XHFMAX=XHFMAX+7.0
             XHFCOR=XHFMAX+DELWE+DELWS+DELRS
             IF(IFLITE.EQ.ISANDL) GO TO 351
             PRINT 246 $PRINT 353,IPLANE,IFLITE
         246 FORMAT(1H1)
         353 FORMAT(1H-,7H*******,3A10,1H,,A10,7H*******)
         351 II=4HH(F) $PRINT 383,II,IBLANK
         383 FORMAT(1H-,*PARAMETERS OF THE TRANSFER FUNCTION FOR: *,A10/43X,A2)
             PRINT 355,XHFMAX,DELRS,DELWE,DELWS,XHFCOR
         355 FORMAT(
            175X,*2*,13X,*-4*,8X,*2  2*/17X,*H (F)=*,F12.2,6X,*MAXIMUM VALUE OF
            2 H(F)-DB.RE. 1.0 G /HZ.,RE.(2X10  DYNES-CM. ) /HZ.*/18X,*M*/
            216X,*DEL R =*,F12.2,6X,*CORRECTION FACTOR TO H (F) FOR R (DB.)*/
            321X,*S*,41X,*M*,9X,*S*/
            416X,*DEL W =*,F12.2,6X,*CORRECTION FACTOR TO H (F) FOR W (DB.)*/
            521X,*E*,41X,*M*,9X,*E*/
            616X,*DEL W =*,F12.2,6X,*CORRECTION FACTOR TO H (F) FOR W (DB.)*/
            821X,*S*,41X,*M*,9X,*S*/
            917X,*H (F)=*,F12.2,6X,*CORRECTED VALUE OF H (F)*/18X,*M*,2X,
            **C*,39X,*M*)

             IF(WE.LE.10.0) GO TO 375
```

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PROGRAM VIPRF      74/74   OPT=1                          FTN 4.5+414        08/16/77  13.11.28

      IF(CATGRY.EQ.C13.OR.CATGRY.EQ.C6) GO TO 375
      PRINT 354
  354 FORMAT(1H0,*NOTE:THE CORRECTION FACTOR FOR W  IS SET EQUAL TO ZERO
     1 EVEN THOUGH W >10 POUNDS.*/33X,*E*,35X,*E*/)


  375 RHFHI=0.6 $IF(RS.GT.0.) RHFHI=0.3
      PRINT 380,BHFLO,BHFHI,XHFLO,XHFHI,FZHFLO,FZHFHI
  380 FORMAT(
     120X,*B =*,F12.3,6X,*SLOPE FACTOR,LOW-FREQ.ROLL-OFF*/
     220X,*B'=*,F12.3,6X,*SLOPE FACTOR,HIGH FREQ.ROLL-OFF*/
     320X,*X =*,F12.3,6X,*NORMALIZING FREQ.RATIO,LOW-FREQ.ROLL-OFF*/
     420X,*X'=*,F12.3,6X,*NORMALIZING FREQ.RATIO,HIGH-FREQ.ROLL-OFF*/
     520X,*F =*,F12.2,6X,*LOCATOR FREQ., LOW FREQ.ROLL-OFF*/21X,*0*/
     620X,*F'=*,F12.2,6X,*LOCATOR FREQ.,HIGH FREQ.ROLL-OFF*/21X,*0*)
      PRINT 382,AK,FRQ
  382 FORMAT(21X,*K=*,F12.4,6X,*CORRECTION FACTOR TO F' FOR W (F'=K X *,
     1F8.1,*)*/63X,*0*,6X,*F*,2X,*0*)
      PRINT 425,AHFLO,AHFHI


C     ************************
C     *                      *
C     *     M(F)             *
C     *                      *
C     ************************
      IF(IFLITE.NE.ISANDL) GO TO 356
      PRINT 246 $PRINT 353,IPLANE,IFLITE
  356 II=4HM(F) $PRINT 383,IT,IBLANK
      FZMFLO=FMFLO $FZMFHI=FMFHI

      DELRS=0. $IF(RS.GE.2.8) GO TO 370
      CALL CLAF(XX,DXMFRS,0.,DELRS,DBMFRS,NMFRS)

  370 DELWS=0.15*DELWS

      IF(CATGRY.EQ.C6) XMFMAX=XMFMAX+2.0
      XMFCOR=XMFMAX+DELWS+DELRS

      PRINT 385,XMFMAX,DELWS,DELRS,XMFCOR
      PRINT 380,BMFLO,BMFHI,XMFLO,XMFHI,FZMFLO,FZMFHI
  385 FORMAT(
     175X,*2*,13X,*-4*,8X,*2  2*/17X,*M (F)=*,F12.2,6X,*MAXIMUM VALUE OF
     2 M(F)-DB.RE. 1.0 G /HZ./RE.(2X10  DYNES-CM. ) /HZ.*/18X,*M*/
     316X,*DEL W =*,F12.2,6X,*CORRECTION FACTOR TO M (F) FOR W (DB.)*/
     421X,*S*,41X,*M*,9X,*S*/
     516X,*DEL R =*,F12.2,6X,*CORRECTION FACTOR TO M (F) FOR R (DB.)*/
     621X,*S*,41X,*M*,9X,*S*/
     717X,*M (F)=*,F12.2,6X,*CORRECTED VALUE OF M (F)*/18X,*M*,2X,*C*,
     839X,*M*)
      PRINT 425,AMFLO,AMFHI


C     ************************
C     *                      *
C     *     L(F)             *
C     *                      *
```

```
          ************************
           M=1HF
           CALL CUAD(XE,DXMOD1,0.,CORLFM,DBMOD1,NMODE1)
           IF(CORLFM.LT.-21.0) CORLFM=-21.0
           XLFCOR=XLFMAX+CORLFM

           IF(IFLITE.EQ.ISANDL) GO TO 387
           PRINT 246 $PRINT 353,IPLANE,IFLITE
       387 II=4HL(F) $PRINT 383,II,IBLANK
           J=1HM $K=1H $L=1HC
           PRINT 390,XLFMAX,J,K,K,CORLFM,XE,IPLANE(1),M,J,M,XLFCOR,J,L,J
       390 FORMAT(
          176X,*2*,12X,*-4*,8X,*2  2*/17X,*L (F)=*,F12.2,5X,*MAXIMUM VALUE OF
          2 L (F)-DB.RE. 1.0 G /HZ.,RE.(2X10  DYNES-CM. ) /HZ.*/18X,A1,2X,A2,
          336X,A1/
          416X,*DEL X =*,F12.2,6X,*CORRECTION FACTOR TO L (F) FOR DISTANCE X
          5=*,F6.2,* CM*,A10,* TYPE AIRCRAFT*/21X,A2,40X,A1,18X,A2/
          617X,*L (F)=*,F12.2,6X,*CORRECTED VALUE OF L (F)*/18X,A1,2X,A2,
          738X,A1)

           FZLFLO=FN/2.0 $FZLFHI=2.0*FN
           BLFLO=BBLFLO $BLFHI=BBLFHI $XLFLO=XXLFLO $XLFHI=XXLFHI

           IF(F2N.EQ.0.) GO TO 395
           BLFHI=0.23 $XLFHI=0.70 $FZLFHI=1.42*FN

       395 PRINT 380,BLFLO,BLFHI,XLFLO,XLFHI,FZLFLO,FZLFHI
           ILINE1(1)=10HFIRST BODY $ILINE1(2)=10H BENDING M
           ILINE1(3)=10HODE FREQUE $ILINE1(4)=8HNCY(HZ.) $ILINE1(5)=1H
           IFN=1HN $PRINT 441,FN,(ILINE1(II),II=1,7),IFN
           PRINT 425,ALFLO,ALFHI


    C     ************************
    C     *                      *
    C     *     L (F)            *
    C     *      2               *
    C     *                      *
    C     ************************
           IF(F2N.EQ.0.) GO TO 399

           CALL CUAD(XE,DXMOD2,0.,CORL2F,DBMOD2,NMODE2)
           IF(CORL2F.LT.-21.0) CORL2F=-21.0
           XL2FCR=XL2FMX+CORL2F

           IF(IFLITE.NE.ISANDL) GO TO 393
           PRINT 246 $PRINT 353,IPLANE,IFLITE
       393 II=5HL (F) $J=1HM $K=1H2 $L=2HMC $PRINT 383,II,K
           PRINT 390,XL2FMX,K,J,K,CORL2F,XE,IPLANE(1),M,K,M,XL2FCR,K,L,K

           FL2FLO=F2N/XL2FLO $FL2FHI=F2N/XL2FHI
           PRINT 380,BL2FLO,BL2FHI,XL2FLO,XL2FHI,FL2FLO,FL2FHI

           ILINE1(1)=10HSECOND BOD $ILINE1(2)=10HY BENDING
           ILINE1(3)=10HMODE FREQU $ILINE1(4)=9HENCY(HZ.) $ILINE1(5)=1H
           IFN=2H2N $PRINT 441,F2N,(ILINE1(II),II=1,7),IFN
           PRINT 425,AL2FLO,AL2FHI
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PROGRAM VIPRF       74/74    OPT=1                          FTN 4.5+414        08/16/77  13.11.28



  383 IFN=1HC $IF(CATGRY.EQ.C4A) IFN=3HC3A $IF(CATGRY.EQ.C4B) IFN=3HC3B
      ILINE1(1)=10HISOLATOR N $ILINE1(2)=10HATURAL FRE
      ILINE1(3)=10HQUENCY(HZ. $ILINE1(4)=1H)


      IF(CATGRY.EQ.C1A) GO TO 398
      IF(CATGRY.EQ.C1B) GO TO 500
      IF(CATGRY.EQ.C2A) GO TO 431
      IF(CATGRY.EQ.C2B) GO TO 433
      IF(CATGRY.EQ.C3A) GO TO 442
      IF(CATGRY.EQ.C3B) GO TO 435
      IF(CATGRY.EQ.C4A) GO TO 398
      IF(CATGRY.EQ.C4B) GO TO 398
      IF(CATGRY.EQ.C5) GO TO 427
      IF(CATGRY.EQ.C6) GO TO 437

C    *************************
C    *                       *
C    *     CATEGORY 1A       *
C    *                       *
C    *************************
  398 DELWE=0. $IF(WE.LE.10.0) GO TO 410
      IF(WE.LT.210.0) GO TO 405
      C1AAHI=1.92 $DELWE=-6.5
      GO TO 410
  405 CALL QUAD(WE,DXC1A,XINC1A,C1AAHI,C1AAWE,NC1A)
      CALL QUAD(WE,DXC1A,XINC1A,DELWE,C1AMWE,NC1A)
  410 C1AMXC=C1AMAX+DELWE

      IF(FCCAT1.EQ.0.) FCCAT1=C1AFN
      C1AFZL=FCCAT1/C1AXLO $C1AFZH=FCCAT1/C1AXHI $FC=FCCAT1


      ILINE2(1)=10H(EQUIPMENT $ILINE2(2)=10H MOUNTED O
      ILINE2(3)=10HN PRIMARY  $ILINE2(4)=10HSTRUCTURE
      ILINE2(5)=10HTHROUGH IS $ILINE2(6)=9HOLATORS)$

      IF(CATGRY.NE.C1A) GO TO 415

      PEAK=C1AMXC $XLO=C1AXLO $XHI=C1AXHI $BLO=C1ABLO $BHI=C1ABHI
      ALO=C1AALO $AHI=C1AAHI $FZLO=C1AFZL $FZHI=C1AFZH
      GO TO 445

  415 PRINT 246 $PRINT 353,IPLANE,IFLITE
      II=EHY (F) $L=2H1A $PRINT 383,II,L $PRINT 438,CATGRY
      PRINT 420,C1AMAX,IPLANE(1),DELWE,WE,C1AMXC
      PRINT 380,C1ABLO,C1ABHI,C1AXLO,C1AXHI,C1AFZL,C1AFZH
      L=3HC1A $PRINT 441,FCCAT1,(ILINE1(K),K=1,7),L
      PRINT 425,C1AALO,C1AAHI

      IF(CATGRY.EQ.C4A) GO TO 442
      GO TO 435


C    *************************
```

```
      C    *                         *
      C    *     CATEGORY 2A         *
      C    *                         *
      C    ***************************
        431 PEAK=C2AMAX $XLO=C2AXLO $XHI=C2AXHI $BLO=C2ABLO $BHI=C2ABHI
            ALO=C2AALO $AHI=C2AAHI

            IF(FCCAT1.EQ.0.) FCCAT1=C2AFN
            FZLO=FCCAT1/XLO $FZHI=FCCAT1/XHI $FC=FCCAT1

            ILINE2(1)=10H(SECONDARY  $ILINE2(2)=10H STRUCTURE
            ILINE2(3)=10H EQUIP.MOU $ILINE2(4)=10HNTED ON IN
            ILINE2(5)=10HSTRUMENT P $ILINE2(6)=10HANEL,ISOL. $ILINE2(7)=2H)$
            GO TO 440


      C    ***************************
      C    *                         *
      C    *     CATEGORY 2B         *
      C    *                         *
      C    ***************************
        433 PEAK=C2BMAX $XLO=C2BXLO $XHI=C2BXHI $BLO=C2BBLO $BHI=C2BBHI
            ALO=C2BALO $AHI=C2BAHI

            IF(FCCAT1.EQ.0.) FCCAT1=C2BFN
            FZLO=FCCAT1/XLO $FZHI=FCCAT1/XHI $FC=FCCAT1

            ILINE1(1)=10HFIRST INST $ILINE1(2)=10HRUMENT PAN
            ILINE1(3)=10HEL RESONAN $ILINE1(4)=7HCE(HZ.)

            ILINE2(1)=10H(SECONDARY $ILINE2(2)=10H STRUCTURE
            ILINE2(3)=10H EQUIP.MOU $ILINE2(4)=10HNTED ON IN
            ILINE2(5)=10HSTRU.PANEL $ILINE2(6)=10H,NON-ISOL. $ILINE2(7)=2H)$
            GO TO 440


      C    ***************************
      C    *                         *
      C    *     CATEGORY 3A         *
      C    *                         *
      C    ***************************
        442 XX=2H3A
            BHI=C3ABHI $XLO=C3AXLO $ALO=C3AALO

            IF(WE.GT.10.0) GO TO 443
            PEAK=C1AMAX $BLO=C1ABLO $XHI=C1AXHI $AHI=C1AAHI
            GO TO 448

        443 IF(WE.LT.200.0) GO TO 444
            PEAK=C3AYMX(NC3) $BLO=C3AB(NC3) $XHI=C3AXP(NC3) $AHI=C3AAP(NC3)
            GO TO 448

        444 CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,PEAK,C3AYMX,NC3)
            CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,BLO,C3AB,NC3)
            CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,XHI,C3AXF,NC3)
            CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,AHI,C3AAF,NC3)
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PROGRAM VIPRF       74/74    OPT=1                                   FTN 4.5+414         08/16/77  13.11.28

                                                                              VIPRF    1541
      448 FC=FCCAT1 $IF(CATGRY.EQ.C4A) FC=FCCAT2 $IF(FC.EQ.0.) FC=C3AFN        VIPRF    1542
          FZLO=FC/XLO $FZHI=FC/XHI                                            VIPRF    1543
                                                                              VIPRF    1544
          ILINE2(1)=10H(EQUIPMENT $ILINE2(2)=10H HARD MOUN                    VIPRF    1545
          ILINE2(3)=10HTED ON ISO $ILINE2(4)=10HLATED SHEL                    VIPRF    1546
          ILINE2(5)=10HF OR BACK  $ILINE2(6)=2H)$                             VIPRF    1547
          GO TO 440                                                           VIPRF    1548
                                                                              VIPRF    1549
                                                                              VIPRF    1550
                                                                              VIPRF    1551
    C     ************************                                            VIPRF    1552
    C     *                      *                                            VIPRF    1553
    C     *     CATEGORY 3B      *                                            VIPRF    1554
    C     *                      *                                            VIPRF    1555
    C     ************************                                            VIPRF    1556
      433 XX=2H3B                                                             VIPRF    1557
                                                                              VIPRF    1558
          ILINE1(1)=10HLOWEST SHE $ILINE1(2)=10HLF FIRST B                    VIPRF    1559
          ILINE1(3)=10HENDING MOD $ILINE1(4)=6HE(HZ.)                         VIPRF    1560
                                                                              VIPRF    1561
          IF(WE.GT.10.0) GO TO 446                                            VIPRF    1562
          BLO=C5BLO $BHI=C5BHI $XLO=C5XLO $XHI=C5XHI $ALO=C5ALO $AHI=C5AHI    VIPRF    1563
          PEAK=-6.0-2.0*(WE-10.0)/3.                                          VIPRF    1564
          GO TO 449                                                           VIPRF    1565
      446 IF(WE.LT.200.0) GO TO 447                                           VIPRF    1566
          BLO=C3BB(NC3) $BHI=C3BBP(NC3) $XLO=C3BX(NC3) $XHI=C3BXP(NC3)        VIPRF    1567
          ALO=C3BA(NC3) $AHI=C33AP(NC3) $PEAK=C3BYMX(NC3)                     VIPRF    1568
          GO TO 449                                                           VIPRF    1569
      447 CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,PEAK,C3BYMX,NC3)                  VIPRF    1570
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,BLO,C3BB,NC3)                     VIPRF    1571
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,BHI,C3BBP,NC3)                    VIPRF    1572
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,XLO,C3BX,NC3)                     VIPRF    1573
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,XHI,C3BXP,NC3)                    VIPRF    1574
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,ALO,C3BA,NC3)                     VIPRF    1575
          CALL TERPLIN(WE,X1,C3WE(1),C3WE,1,AHI,C3BAP,NC3)                    VIPRF    1576
                                                                              VIPRF    1577
                                                                              VIPRF    1578
      449 FC=FCCAT1 $IF(CATGRY.EQ.C4B) FC=FCCAT2 $IF(FC.EQ.0.) FC=C3BFN        VIPRF    1579
          FZLO=FC/XLO $FZHI=FC/XHI                                            VIPRF    1580
                                                                              VIPRF    1581
          ILINE2(1)=10H(EQUIPMENT $ILINE2(2)=10H HARD MOUN                    VIPRF    1582
          ILINE2(3)=10HTED ON NON $ILINE2(4)=10H-ISOLATED                     VIPRF    1583
          ILINE2(5)=10HSHELF OR B $ILINE2(6)=5HACK)$                          VIPRF    1584
          GO TO 440                                                           VIPRF    1585
                                                                              VIPRF    1586
                                                                              VIPRF    1587
    C     ************************                                            VIPRF    1588
    C     *                      *                                            VIPRF    1589
    C     *     CATEGORY 5       *                                            VIPRF    1590
    C     *                      *                                            VIPRF    1591
    C     ************************                                            VIPRF    1592
      427 DELWE=0. $IF(WE.LE.1.0) GO TO 436                                   VIPRF    1593
          DELWE=-6.0 $IF(WE.GE.10.0) GO TO 436                                VIPRF    1594
          DELWE=-6.0-2.0*(WE-10.0)/3.                                         VIPRF    1595
      436 PEAK=C5MAX+DELWE                                                    VIPRF    1596
          BLO=C5BLO $BHI=C5BHI $XLO=C5XLO $XHI=C5XHI $ALO=C5ALO $AHI=C5AHI    VIPRF    1597
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PROGRAM VIPRF       74/74    OPT=1                              FTN 4.5+414          08/16/77  13.11.28

          IF(FCCAT1.EQ.0.) FCCAT1=25EN
          FZLO=FCCAT1/XLO $FZHI=FCCAT1/XHI $FC=FCCAT1

          ILINE2(1)=10H(LIGHT WEI $ILINE2(2)=10HGHT EQUIP.
          ILINE2(3)=10HMOUNTED ON $ILINE2(4)=10H PRIMARY S
          ILINE2(5)=10HTRUCTURE B  $ILINE2(6)=10HY BRACKETS
          ILINE2(7)=2H)3

          ILINE1(1)=10HLOWEST NAT $ILINE1(2)=10HURAL FREQU
          ILINE1(3)=10HENCY OF BR $ILINE1(4)=10HACKET AND
          ILINE1(5)=10HEQUIPMENT  $ILINE1(6)=10HCOMBINATIO
          ILINE1(7)=5HN(HZ.)
          GO TO 440

C     ************************
C     *                      *
C     *     CATEGORY 6       *
C     *                      *
C     ************************

  437 IF(IFLITE.NE.ISANDL) PRINT 246
      PRINT 439
  439 FORMAT(1H-,*TRANSFER FUNCTION FOR CATEGORY 6:  EQUIP.MOUNTED ON,OR
     1 ATTACHED TO FORWARD LOOKING RADAR BULK-HEADS*///
     2* FOR THIS CATEGORY Y(F)=1 AT ALL FREQUENCIES SO THAT R(F)=Y(F)G(F
     3)=G(F).*/
     4* CHANGES ARE MADE AS FOLLOWS WHEN THIS CATEGORY IS SPECIFIED:*//
     520X,*H(F):7.0 DB IS ADDED TO H(F)*/45X,*M*/
     622X,*F : F =350.0T/0.035(T DENOTES PLATE THICKNESS)*/23X,*0*4X*0*/
     720X,*M(F):2.0 DB IS ADDED TO M(F)*/45X,*M*)
      GO TO 600


  440 IF(IFLITE.NE.ISANDL) PRINT 246
      II=5HY (F) $J=1HM $M=1H
      PRINT 383,II,XX
      IF(CATGRY.EQ.C4A.OR.CATGRY.EQ.C4B) PRINT 438,CATGRY
      IF(CATGRY.EQ.C5) PRINT 420,C5MAX,IPLANE(1),DELWE,WE,PEAK
      IF(CATGRY.NE.C5) PRINT 352,II,PEAK,II,IPLANE(1),J,M,M
      PRINT 380,SLO,SHI,XLO,XHI,FZLO,FZHI

      PRINT 441,FC,(ILINE1(II),II=1,7),IFN
      PRINT 425,ALO,AHI
  420 FORMAT(
     217X,*Y (F)=*,F12.2,6X,*MAXIMUM VALUE OF Y(F)-DB.,FOR*,A10,
     3*TYPE AIRCRAFT*/18X,*M*/
     416X,*DEL W =*F12.2,6X,*CORRECTION FACTOR TO Y (F) FOR EQUIPMENT WE
     5IGHT W =*,F6.1 * LBS.*/21X,*E*,41X,*M*,26X,*E*/
     617X,*Y (F)=*,F12.2,6X,*CORRECTED VALUE OF Y (F)*/18X,*M*,2X,*C*,
     739X,*M*)
  425 FORMAT(
     116X,*ALPHA =*,F12.3,6X,*FORM FACTOR,LOW-FREQ.ROLL-OFF*/
     216X,*ALPHA'=*,F12.3,6X,*FORM FACTOR,HIGH-FREQ.ROLL-OFF*)
  438 FORMAT(42X,*(REQUIRED WHEN CATEGORY *,A2,* EQUIPMENT MOUNTING IS S
     1PECIFIED)*//)
```

```
PROGRAM VIPRF       74/74    OPT=1                      FTN 4.5+414        08/16/77  13.11.28

     441 FORMAT(20X,*F =*,F12.2,6X,7A10/21X,A3)



C      ************************
C      *                      *
C      *    L(F)-M(F)-H(F)    *
C      *                      *
C      ************************
     600 TWOB(1)=2.*BLFLO $TWOB(2)=2.*BMFLO $TWOB(3)=2.*BHFLO
         FZ(1)=FZLFLO $FZ(2)=FZMFLO $FZ(3)=FZHFLO
         XFERMX(1)=XLFCOR $XFERMX(2)=XMFCOR $XFERMX(3)=XHFCOR

         FLX(1)=ATAN2(TWOB(1)*(XLFLO**ALFLO),1.-XLFLO*XLFLO)
         FLX(2)=ATAN2(TWOB(2)*(XMFLO**AMFLO),1.-XMFLO*XMFLO)
         FLX(3)=ATAN2(TWOB(3)*(XHFLO**AHFLO),1.-XHFLO*XHFLO)

         ALPHA(1)=ALFLO $ALPHA(2)=AMFLO $ALPHA(3)=AHFLO
         HILO(1)=0. $HILO(2)=0. $HILO(3)=0.
         SIGN(1)=1.0 $SIGN(2)=1.0 $SIGN(3)=1.0 $K=3 $DB(4)=-1000.0


         J=0 $CONST=0.10 $II=1 $L=0
         FRQ=FMINGE $FMAX=XLFLO*FZLFLO

         IF(F2N.EQ.0.) GO TO 620
         X1=XL2FLO*FL2FLO $IF(X1.GE.FMAX) GO TO 610
         PRINT 605,X1,FMAX
     605 FORMAT(1H-,*THE FREQUENCY AT WHICH THE MAXIMUM VALUE OF L2(F) OCCU
        1RS,*,G12.5,* HZ.*/* IS LESS THAN THE CORRESPONDING FREQUENCY FOR L
        2(F),*,G12.5/* THE PROGRAM ASSUMES THAT THE FREQUENCY OF THE MAXIMU
        3M VALUE OF L2(F) WILL BE*/* GREATER THAN OR EQUAL TO THE CORRESPON
        4DING FREQUENCY OF L(F).*)
         GO TO 1000

     610 TWOB(4)=2.0*BL2FLO $FZ(4)=FL2FLO $ALPHA(4)=AL2FLO
         XFERMX(4)=XL2FCR
         FLX(4)=ATAN2(TWOB(4)*(XL2FLO**AL2FLO),1.-XL2FLO*XL2FLO)
         K=4 $HILO(4)=0. $SIGN(4)=1.0


     620 IF(FMAX.LE.FMINGE) GO TO 625
         CALL GEOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFERMX,TWOB,FLX,FZ,
        1HILO,SIGN,ALPHA,II,J,K,L)
         FRQ=FMAX

     625 FMAX=XMFLO*FZMFLO
         TWOB(1)=2.*BLFHI $FZ(1)=FZLFHI $ALPHA(1)=ALFHI
         FLX(1)=PI-ATAN2(TWOB(1)*(XLFHI**ALFHI),1.-XLFHI*XLFHI)
         HILO(1)=PI $SIGN(1)=-1.0

         IF(F2N.EQ.0.) GO TO 640
         IF(X1.LE.FRQ) GO TO 630


         FMAX=X1 $II=1
         CALL GEOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFERMX,TWOB,FLX,FZ,
```

```
     1HILO,SIGN,ALPHA,II,J,K,L)
      FRQ=FMAX $FMAX=XMFLO*FZMFLO

630   TWOB(4)=2.0*BL2FHI $FZ(4)=FL2FHI $ALPHA(4)=AL2FHI
      FLX(4)=PI-ATAN2(TWOB(4)*(XL2FHI**AL2FHI),1.-XL2FHI*XL2FHI)
      HILO(4)=PI $SIGN(4)=-1.0

640   II=1
      CALL GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFFRMX,TWOB,FLX,FZ,
     1HILO,SIGN,ALPHA,II,J,K,L)

      FRQ=FMAX $FMAX=XMFHI*FZMFHI
      IF(FMAX.EQ.FRQ) GO TO 580
      DB(2)=XMFCCR $II=1 $L=2
      CALL GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFFRMX,TWOB,FLX,FZ,
     1HILO,SIGN,ALPHA,II,J,K,L)


580   FRQ=FMAX $FMAX=XHFLO*FZHFLO
      TWOB(2)=2.0*BMFHI $FZ(2)=FZMFHI $ALPHA(2)=AMFHI
      FLX(2)=PI-ATAN2(TWOB(2)*(XMFHI**AMFHI),1.-XMFHI*XMFHI)
      HILO(2)=PI $SIGN(2)=-1. $II=1 $L=0
      CALL GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFFRMX,TWOB,FLX,FZ,
     1HILO,SIGN,ALPHA,II,J,K,L)


      FRQ=FMAX $FMAX=XHFHI*FZHFHI
      IF(FMAX.EQ.FRQ) GO TO 590
      DB(3)=XHFCCR $II=1 $L=3
      CALL GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFFRMX,TWOB,FLX,FZ,
     1HILO,SIGN,ALPHA,II,J,K,L)


590   FRQ=FMAX $FMAX=FMAXGF
      TWOB(3)=2.0*BHFHI $FZ(3)=FZHFHI $ALPHA(3)=AHFHI
      FLX(3)=PI-ATAN2(TWOB(3)*(XHFHI**AHFHI),1.-XHFHI*XHFHI)
      HILO(3)=PI $SIGN(3)=-1. $II=1 $L=0
      CALL GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFFRMX,TWOB,FLX,FZ,
     1HILO,SIGN,ALPHA,II,J,K,L)
      NPTS=J

C    ************************
C    *                      *
C    *       P(F)           *
C    *                      *
C    ************************

      LXNAME(1)=10H(F)REQUENC $LXNAME(2)=10HY((H)Z())$
      X=XE $YSTEP=5.0

      IF(INCPLT.EQ.IBLANK) GO TO 459
      IPLOT=IPLOT+1

      LYNAME(1)=10H(P()F())-D $LYNAME(2)=4H(B)$
      ILINE1(1)=10H(BOUNDARY $ILINE1(2)=10HLAYER PSD) $ILINE1(3)=1H$
```

```
PROGRAM VIPRF        74/74    OPT=1                          FTN 4.5+414          08/16/77   13.11.28

          J=10H(S()F())=$ $M=9H B(S) DB.

      459 TWOBPF=2.*BPF $FLXPF=PI-ATAN2(TWOBPF*(XPF**APFHI),1.-XPF*XPF)
          DO 460 II=1,NPTS
          K=II $X1=FREQ(II) $IF(X1.GE.FMINPF) GO TO 463
          X1=X1/FZPF
          X1=PEMDB+20.*ALOG10((PI-ATAN2(TWOBPF*(X1**APFHI),1.-X1*X1))/FLXPF)
      460 DBTL(II)=X1

      463 L=0
          DO 465 II=K,NPTS
          L=L+1 $X1=FREQ(II) $FSFL(L)=X1 $X1=X1/FZPF
          X1=PEMDB+20.*ALOG10((PI-ATAN2(TWOBPF*(X1**APFHI),1.-X1*X1))/FLXPF)
      465 DBTL(II)=X1


          IF(IFLITE.NE.ISANDL) GO TO 465


          FRO=FMAXPF
      467 FRO=FRO+DCNST*FRO $IF(FRO.GT.FMAXPF) GO TO 472
          L=L+1 $FSFL(L)=FRO
          GO TO 467


      472 CALL CNEFUN(FSFL,DBSPL,L,PEMDB,0.,BPF,0.,XPF,0.,FZPF,0.,APFHI,
         1FMINPF,FMAXPF,DBMIN,C,IFIRST,J,M,1H ,2HHI)


          IF(INOPLT.EQ.IBLANK) GO TO 475
          CALL ENDPL(IPLOT) $GO TO 473


C     ************************
C     *                      *
C     *     S(F)             *
C     *                      *
C     ************************
      455 IPHASE=0 $IF(INOPLT.EQ.IBLANK) GO TO 457
          IPHASE=1 $II=5H S(F)
          IF(IFLITE.EQ.IFUEET.AND.SPTED.LT.SDELTA) GO TO 450
          IF(IFLITE.EQ.ITURB) GO TO 450
          PRINT 458,II,IX,SBLO,BPF,SBHI,SXLO,XPF,SXHI,SFZLO,FZPF,SFZHI,SALC,
         1APFHI,SAHI,PEMDB,SPEAK
      458 FORMAT(1H1,*PARAMETERS*,3X,*P(F)*,8X,A10/28X,A2/
         18X,*B =*,11X,G12.3/6X,*B'=*,G11.3,G12.3/
         28X,*X =*,11X,G12.3/8X,*X'=*,G11.3,G12.3/8X,*F =*,11X,G12.5/9X,*0*/
         38X,*F'=*,G11.5,G12.5/9X,*0*/4X,*ALPHA =*,11X,G12.3/4X,*ALPHA'=*,
         4G11.3,G12.3/2X,*MAX.VAL.=*,G11.4,G12.4)
          M=4HBOTH $GO TO 452

      450 PRINT 451,II,IX,BPF,SBHI,XPF,SXHI,FZPF,SFZHI,APFHI,SAHI,PEMDB,
         1SPEAK
      451 FORMAT(1H1,*PARAMETERS*,3X,*P(F)*,8X,A10/27X,A2/
         18X,*B"=*,G11.3,G12.3/8X,*X'=*,G11.3,G12.3/
         28X,*F"=*,G11.4,G12.4/4X,*ALPHA'=*,G11.3,G12.3/
```

```
         32X,*MAX.VAL.=*,G11.4,G12.4)
          M=2HHT


     452 K=7H    D(F) $L=5H P(F)
          PRINT 790,II,K,IBLANK
          PRINT 461,II,K,L,IBLANK
     461 FORMAT(1H-,3X,*FREQUENCY(HZ.)*,9X,A5,10X,A10,11X,A5,12X,A10)
          PRINT 455,IX,IBLANK,IX
     455 FORMAT(29X,A2,15X,A2,17X,A2)

     457 CALL XFERFUN(FREQ,DBSPL,NPTS,SPEAK,SXLO,SXHI,SBLO,SBHI,
        1SFZLO,SFZHI,SALO,SAHI,M)

          DO 453 K=1,NPTS
          IF(DBSPL(K).LT.0.) DBSPL(K)=0.
     453 CONTINUE


          CALL TWOFUN(FREQ,DBSPL,DBFL,NPTS,FMINGF,FMAXGF,DBMIN,DYVAL)

          IF(INCPLT.EQ.IBLANK) GO TO 475


          K=2HHT
          IF(IFLITE.EQ.IBUFFT.AND.SBTED.LT.SDELTA) GO TO 456
          IF(IFLITE.EQ.ITURB) GO TO 456
          K=4HBOTH
          IF(SFZLO.LT.FMINGF) GO TO 456
          FLX1=ATAN2(2.*SBLO*(SXLO**SALO),1.-SXLO*SXLO)
          IF(FLX1.LT.0.) FLX1=FLX1+2.0*PI
          X1=SPEAK+20.*ALOG10(PI/(2.*FLX1)) $X2=SFZLO/FZPF
          X2=PFMDB+20.*ALOG10((PI-ATAN2(TWOBPF*(X2**APFHI),1.-X2*X2))/FLXPF)
          YVAL=X1+X2 $CALL CURVE(SFZLO,YVAL,1,1)

     456 FLX1=PI-ATAN2(2.*SBHI*(SXHI**SAHI),1.-SXHI*SXHI)
          X1=SPEAK+20.*ALOG10(PI/(2.*FLX1)) $X2=SFZHI/FZPF
          X2=PFMDB+20.*ALOG10((PI-ATAN2(TWOBPF*(X2**APFHI),1.-X2*X2))/FLXPF)
          YVAL=X1+X2 $CALL CURVE(SFZHI,YVAL,1,1)

          CALL HEIGHT(HITE1)
          CALL LOCFBXA(SBLO,SBHI,SXLO,SXHI,SFZLO,SFZHI,SALO,SAHI,FMINGF,
        1FMAXGF,YVAL,DYVAL,K)

          CALL ENDPL(IPLOT)

C    ************************
C    *                      *
C    *     H(F)             *
C    *                      *
C    ************************


     475 IPLOT=IPLOT+1
          LYNAME(1)=10H(H(F)(()F()) $LYNAME(2)=6H-D(B)$
          ILINE1(1)=10H(HIGH FREQ $ILINE1(2)=10HUENCY TRAN
```

```
PROGRAM VIPRF       74/74    OPT=1                         FTN 4.5+414          08/16/77  13.11.28

          ILINE1(3)=10HSFER FUNCT $ILINE1(4)=5HION)$
          ITITL1(1)=10H(PRIMARY S $ITITL1(2)=10HTRUCTURE-F
          ITITL1(3)=9HUSELAGE)$
          II=10H(H()F())=$ $J=9H H(F) DB.


      475 K=0 $CONST=0.07 $FRQ=FMINHF $FMAX=XHFLO*FZHFLO $L=0
      480 K=K+1 $FSPL(K)=FRQ
          FRQ=FRQ+CONST*FRQ $IF(FRQ.LT.FMAX) GO TO 480
          IF(L.EQ.1) GO TO 505
          L=1 $FRQ=FMAX $FMAX=FMAXHF
          X1=XHFHI*FZHFHI $IF(FRQ.EQ.X1) GO TO 480
          K=K+1 $FSPL(K)=FRQ $FRQ=X1 $GO TO 480


      505 CALL CNEFUN(FSPL,DBSPL,K,XHFCOR,BHFLO,BHFHI,XHFLO,XHFHI,FZHFLO,
         1FZHFHI,AHFLO,AHFHI,FMINHF,FMAXHF,DBMIN,0,IFIRST,II,J,1H ,4HBOTH)


          IPHASE=1 $IF(INOPLT.NE.IBLANK) GO TO 508
          IF(CATGRY.EQ.C18) GO TO 507
          IPHASE=0 $GO TO 520

      508 XVAL=1.10*FMINHF $CALL HEIGHT(HITE1)
          DYVAL=1.5*HITE*YSTEP $YVAL=DBMIN+YSTEP+1.5*DYVAL
          CALL RLMESS("(W) =$",+100,XVAL,YVAL)
          CALL RLREAL(WS,+2,"ABUT","ABUT")
          CALL RLMESS(" PSF.$",+100,"ABUT","ABUT")
          CALL RLMESS(" S $",+100,XVAL,YVAL-0.5*DYVAL)

          CALL RLMESS("(P) =$",+100,XVAL,YVAL-1.5*DYVAL)
          CALL RLREAL(RS,+1,"ABUT","ABUT")
          CALL RLMESS(" IN.$",+100,"ABUT","ABUT")
          CALL RLMESS(" S $",+100,XVAL,YVAL-2.0*DYVAL)
          CALL RLMESS("(W) =$",+100,XVAL,YVAL-3.0*DYVAL)
          CALL RLREAL(WE,+1,"ABUT","ABUT")
          CALL RLMESS(" LBS.$",+100,"ABUT","ABUT")
          CALL HEIGHT(0.7*HITE1)
          CALL RLMESS(" (E)$",+100,XVAL,YVAL-3.5*DYVAL)
          CALL HEIGHT(HITE1)
          CALL RESET("BASALF") $CALL RLMESS(IFLITE,10,XVAL,YVAL-4.5*DYVAL)
          CALL BASALF("L/CSTD")
          CALL HEIGHT(HITE)
          CALL ENDPL(IPLOT)


    C     *************************
    C     *                       *
    C     *    C(F)               *
    C     *                       *
    C     *************************


      507 IPLOT=IPLOT+1

          LYNAME(1)=10H(G()F())-D $LYNAME(2)=10H(B)(()RE.1
          LYNAME(3)=10H (G.S)C./( $LYNAME(4)=7HH)7())$
```

```
          ILINE1(1)=10H(RESPONSE  $ILINE1(2)=10HOF PRIMARY
          ILINE1(3)=10H STRUCTURE $ILINE1(4)=2H)$
          ITITL1(1)=2H $ $YSTEP=5.0

          PRINT 246 $PRINT 353,IPLANE,IFLITE

          IF(F2N.NE.0.) GO TO 514
          PRINT 509
      509 FORMAT(1H-,4X,*PARAMETERS*,3X,*P(F)*,5X,*L(F)*,5X,*M(F)*,5X*H(F)*)
          II=1HP $K=2HB*
          PRINT 511,II,BLFLO,BMFLO,BHFLO
      511 FORMAT(9X,A4,F18.3,3F9.3)
          PRINT 512,K,BPF,BLFHI,BMFHI,BHFHI
      512 FORMAT(9X,A4,5F9.3)
          II=1HX $K=2HX*
          PRINT 511,II,XLFLO,XMFLO,XHFLO
          PRINT 512,K,XPF,XLFHI,XMFHI,XHFHI
          II=1HF $K=2HF* $L=1HC
          PRINT 511,II,FZLFLO,FZMFLO,FZHFLO
          PRINT 513,L
      513 FORMAT(10X,A1)
          PRINT 512,K,FZPF,FZLFHI,FZMFHI,FZHFHI
          PRINT 513,L
          II=1HA $K=2HA*
          PRINT 511,II,ALFLO,AMFLO,AHFLO
          PRINT 512,K,APFHI,ALFHI,AMFHI,AHFHI
          II=4HMAX.
          PRINT 512,II,PFMDB,XLFCOR,XMFCOR,XHFCOR
          GO TO 518


      514 PRINT 521
      521 FORMAT(1H-,4X,*PARAMETERS*,3X,*P(F)*,5X,*L(F)*,5X,*L  (F)*,5X,
         1*M(F)*,5X,*H(F)*/37X,*2*)
          II=1HP $K=2HP*
          PRINT 511,II,BLFLO,BL2FLO,BMFLO,BHFLO
          PRINT 512,K,BPF,BLFHI,BL2FHI,BMFHI,BHFHI
          II=1HX $K=2HX*
          PRINT 511,II,XLFLO,XL2FLO,XMFLO,XHFLO
          PRINT 512,K,XPF,XLFHI,XL2FHI,XMFHI,XHFHI
          II=1HF $K=2HF* $L=1HC
          PRINT 511,II,FZLFLO,FL2FLO,FZMFLO,FZHFLO
          PRINT 513,L
          PRINT 512,K,FZPF,FZLFHI,FL2FHI,FZMFHI,FZHFHI
          PRINT 513,L
          II=1HA $K=2HA*
          PRINT 511,II,ALFLO,AL2FLO,AMFLO,AHFLO
          PRINT 512,K,APFHI,ALFHI,AL2FHI,AMFHI,AHFHI
          II=4HMAX.
          PRINT 512,II,PFMDB,XLFCOR,XL2FCR,XMFCOR,XHFCOR

      518 II=5H P(F) $K=9H L-M-H(F) $L=5H G(F) $M=10H G SQ./HZ.
          PRINT 790,II,K,L $PRINT 461,II,K,L,M $PRINT 455,IX,IBLANK,IBLANK


      520 CALL TWOFUN(FREQ,DBEL,DECBEL,NPTS,FMINGF,FMAXGF,DBMIN,DYVAL)
```

```
      IF(CATGRY.NE.C1B) GO TO 774
      CALL ENDPL(IPLOT) $GO TO 860

  774 IPHASE=0 $IF(INOPLT.EQ.IBLANK) GO TO 775
      IPHASE=1 $CALL ENDPL(IPLOT)

C     ************************
C     *                      *
C     *    Y(F)              *
C     *                      *
C     ************************
      IPLOT=IPLOT+1
      LYNAME(1)=10H(Y()F())-D $LYNAME(2)=10H(B()RE.1.0 $LYNAME(3)=4H())$
      ILINE1(1)=10H(TRANSFER  $ILINE1(2)=10HFUNCTION F $ILINE1(3)=4HOR)$

      DO 774 II=1,7
  77? ITITL1(II)=ILINE?(II)

      II=10H(Y()F())=$ $K=10H Y (F) DB. $YSTEP=5.0
      X1=CATGRY $IF(CATGRY.EQ.C4A) X1=2H3A
      IF(CATGRY.EQ.C4B) X1=2H3B


  775 IF(CATGRY.NE.C6) GO TO 785

      DO 780 II=1,NPTS
  780 DBEL(II)=0.
      GO TO 787

  785 CALL COEFUN(FREQ,DBEL,NPTS,PEAK,BLO,BHI,XLO,XHI,FZLO,FZHI,ALO,AHI,
     1FMINGF,FMAXGF,DBMIN,1,IFIRST,II,K,X1,4HBOTH)

  787 IPHASE=1 $IF(INOPLT.NE.IBLANK) GO TO 788
      IF(CATGRY.NE.C4A.AND.CATGRY.NE.C4B) GO TO 789
      IPHASE=0 $GO TO 800

  788 CALL ENDPL(IPLOT)


C     ************************
C     *                      *
C     *    R(F)              *
C     *                      *
C     ************************
  789 IPLOT=IPLOT+1
      PRINT 246 $PRINT 353,IPLANE,IFLITE
      II=6H Y (F) $K=7H   G(F) $L=5H R(F) $M=10H G SQ./HZ.
      PRINT 790,II,K,L
  790 FORMAT(1H-,*VALUES CALCULATED FOR FUNCTIONS: *,7A10)
      PRINT 461,II,K,L,M

      II=2H3A $IF(CATGRY.EQ.C4A) GO TO 793
      II=2H3B $IF(CATGRY.EQ.C4B) GO TO 793
      PRINT 455,CATGRY,IBLANK,IBLANK
      GO TO 795
```

PROGRAM VIPRF 74/74 OPT=1 FTN 4.5+414 08/16/77 13.11.28

```
      793 PRINT 455,II,IBLANK,IBLANK


      795 LYNAME(1)=10H(R()F())-D $LYNAME(2)=10H(B)(()RF.1
          LYNAME(3)=10H (G.S)G./( $LYNAME(4)=7HH)Z())$
          ILINE1(1)=10H(RESPONSE  $ILINE1(2)=10HOF THE AIR
          ILINE1(3)=10HCRAFT EQUI $ILINE1(4)=7HPMENT)$
          ITITL1(1)=2H $


      800 CALL TWOFUN(FREQ,DBEL,DEGREL,NPTS,FMINGF,FMAXGF,DBMIN,DYVAL)

          IF(CATGRY.EQ.C4A.OR.CATGRY.EQ.C4B) GO TO 805
          CALL ENDPL(IPLOT) $GO TO 860
      805 LYNAME(2)=10H(B)(()RF.1
          LYNAME(3)=10H (G.S)Q./( $LYNAME(4)=7HH)Z())$
          IF(INCFLT.EQ.IBLANK) GO TO 810
          CALL ENDPL(IPLOT)



C     ************************
C     *                      *
C     *     Y(F)             *
C     *      1A              *
C     *                      *
C     ************************


          IPLOT=IPLOT+1

          LYNAME(1)=10H(Y()F())-D
          ILINE1(1)=10H(TRANSFER  $ILINE1(2)=10HFUNCTION F $ILINE1(3)=4HOR)$

          ITITL1(1)=10H(EQUIPMENT $ITITL1(2)=10H MOUNTED O
          ITITL1(3)=10HN PRIMARY  $ITITL1(4)=10HSTRUCTURE
          ITITL1(5)=10HTHROUGH IS $ITITL1(6)=9HOLATORS)$
          II=10H(Y()F())=$ $K=10H Y (F) DB. $YSTEP=5.0 $L=2H1A

      810 CALL ONEFUN(FREQ,DBEL,NPTS,C1AMXG,C1ABLO,C1ABHI,C1AXLO,C1AXHI,
         1C1AFZL,C1AFZH,C1AALO,C1AAHI,FMINGF,FMAXGF,DBMIN,1,IFIRST,II,K,L,
         24HBOTH)

          IF(INCFLT.NE.IBLANK) CALL ENDPL(IPLOT)


C     ************************
C     *                      *
C     *     A(F)             *
C     *                      *
C     ************************
          IPLOT=IPLOT+1
          IPHASE=1
          PRINT 246 $PRINT 353,IPLANE,IFLITE
          II=6H Y (F) $J=8H   P (F) $K=6H A (F) $M=10H G SQ./HZ.
          L=2H3A $IF(CATGRY.EQ.C4B) L=2H3B
```

```
PROGRAM VIPRF      74/74   OPT=1                    FTN 4.5+414        08/16/77  13.11.28

      PRINT 790,II,J,K $PRINT 461,II,J,K,M
      M=2H1A $PRINT 455,M,L,CATGRY

      LYNAME(1)=10H(A()E())-D
      ILINE1(1)=10H(INPUT TO $ILINE1(2)=10HTHE AIRCRA
      ILINE1(3)=10HFT EQUIPME $ILINE1(4)=4HNT)$

      ITITL1(1)=10H(EQUIPMENT $ITITL1(2)=10H MOUNTED T
      ITITL1(3)=10HHROUGH ISO $ITITL1(4)=10HLATORS ON

      IF(CATGRY.EQ.043) GO TO 820

      ITITL1(5)=10HISOLATED S $ITITL1(6)=10HHELF OR RA
      ITITL1(7)=4HCK)$
      GO TO 940

  820 ITITL1(5)=10HNON-ISOL.S $ITITL1(6)=10HHELF OR RA
      ITITL1(7)=4HCK)$


  940 CALL TWOFUN(FREQ,DBEL,DEGREL,NPTS,FMINGE,FMAXGE,DBMIN,DYVAL)


      CALL ENDPL(IPLOT)


  960 IF(JFLITE.EQ.ISANDL.OR.ICK.EQ.1) GO TO 1000
      IFLITE=JFLITE $ICK=1 $GO TO 3

 1000 CONTINUE
      IF(IERROR.EQ.4) GO TO 990
      IF(IERROR.NE.3) GO TO 1
      IPLANE(1)=IHOLD(1) $IPLANE(2)=IHOLD(2)
      IPLANE(3)=IHOLD(3) $JFLITE=IHOLD(4)
      INCPLT=IHOLD(5)
      GO TO 31


  990 CALL DONEPL


      PRINT 930
  930 FORMAT(1H1,45X,*AVERAGE*,23X,*AVERAGE*,8X,*SPEED*,9X,*AVERAGE*,
     16X,*AV.KINEMATIC*/31X,*AVERAGE*,7X,*PRESSURE*,7X,*AVERAGE*,
     29X,*DENSITY*,10X,*OF*,9X,*KINEMATIC*,7X,*VISCOSITY*/
     315X,*ALTITUDE*,7X,*PRESSURE*,6X,*NORMALIZED*,6X,*DENSITY*,
     48X,*NORMALIZED*,6X,*SOUND*,8X,*VISCOSITY*,7X,*NORMALIZED*)
      DO 910 I=1,61
      PNORM=AVP(I)/AVP(1) $DNORM=AVDENS(I)/AVDENS(1)
      VNORM=VISCOS(I)/VISCOS(1)
  910 PRINT 920,ALTITUD(I),AVP(I),PNORM,AVDENS(I),DNORM,SOUND(I),
     1VISCOS(I),VNORM
  920 FORMAT(F22.0,F15.1,F15.4,F15.7,F15.4,F15.1,F15.7,F15.4)
      STOP
      END
```

```
        PROGRAM VIPRF       74/74   OPT=1                         FTN 4.5+414        08/16/77  13.11.28

     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
 6152   VIPRF

VARIABLES       SN  TYPE           RELOCATION
20627  AHFHI       REAL                        20626  AHFLO      REAL
20644  AHFMAX      REAL                        21067  AHI        REAL
21024  AK          REAL                        20632  ALFHI      REAL
20631  ALFLO       REAL                        20731  ALNAHI     REAL
20730  ALNALO      REAL                        20725  ALNBHI     REAL
20724  ALNBLO      REAL                        20732  ALNMAX     REAL
20727  ALNXHI      REAL                        20726  ALNXLO     REAL
21066  ALO         REAL                        22500  ALPHA      REAL       ARRAY
22464  ALT         REAL       ARRAY            24214  ALTTUD     REAL       ARRAY
20642  AL2FHI      REAL                        20641  AL2FLO     REAL
22472  AMAKNO      REAL       ARRAY            20634  AMFHI      REAL
20633  AMFLO       REAL                        20643  AMFMAX     REAL
20630  AFFHI       REAL                        24406  AVDENS     REAL       ARRAY
24311  AVP         REAL       ARRAY            20611  BBLFHI     REAL
20610  BBLFLO      REAL                        23636  BFZPF      REAL       ARRAY
20623  BHFHI       REAL                        20622  BHFLO      REAL
21065  BHI         REAL                        21046  BLFHI      REAL
21045  BLFLO       REAL                        21064  BLO        REAL
20636  BL2FHI      REAL                        20635  BL2FLO     REAL
20617  BMFHI       REAL                        20616  BMFLO      REAL
20777  BFF         REAL                        20713  BUFAHI     REAL
20712  BUFALO      REAL                        20707  BUFBHI     REAL
20714  BUFDEL      REAL                        20711  BUFFZH     REAL
20710  BUFFZL      REAL                            4  BUFMAX     REAL                 KARDS
20706  BUFXHI      REAL                        20705  BUFXLO     REAL
20765  C           REAL                            7  CATGRY     REAL                 PPLOTT
21030  CONST       REAL                        21037  CORLFM     REAL
21051  CORL2F      REAL                        13734  C1A        REAL
20652  C1AAHI      REAL                        20651  C1AALO     REAL
23610  C1AAWE      REAL       ARRAY            20650  C1ABHI     REAL
20647  C1ABLO      REAL                        20653  C1AFN      REAL
21057  C1AFZH      REAL                        21056  C1AFZL     REAL
20654  C1AMAX      REAL                        23623  C1AMWE     REAL       ARRAY
21055  C1AMXC      REAL                        20646  C1AXHI     REAL
20645  C1AXLO      REAL                        13742  C1B        REAL
13735  C2A         REAL                        20662  C2AAHI     REAL
20661  C2AALO      REAL                        20660  C2ABHI     REAL
20657  C2ABLO      REAL                        20663  C2AFN      REAL
20664  C2AMAX      REAL                        20656  C2AXHI     REAL
20655  C2AXLO      REAL                        13736  C2B        REAL
20672  C2BAHI      REAL                        20671  C2BALO     REAL
20670  C2BBHI      REAL                        20667  C2BBLO     REAL
20673  C2BFN       REAL                        20674  C2BMAX     REAL
20666  C2BXHI      REAL                        20665  C2BXLO     REAL
13737  C3A         REAL                        20742  C3AALO     REAL
24721  C3AAP       REAL       ARRAY            25053  C3AB       REAL       ARRAY
20740  C3ABHI      REAL                        20743  C3AFN      REAL
20741  C3AXLO      REAL                        24733  C3AXP      REAL       ARRAY
24707  C3AYMX      REAL       ARRAY            13740  C3B        REAL
25041  C3BA        REAL       ARRAY            25027  C3BAP      REAL       ARRAY
24745  C3BB        REAL       ARRAY            24771  C3BBP      REAL       ARRAY
```

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VARIABLES	SN	TYPE	RELOCATION						
20744	C3BEN	REAL			24757	C3BX	REAL	ARRAY	
25003	C3BXP	REAL	ARRAY		25015	C3BYMX	REAL	ARRAY	
24675	C3WE	REAL	ARRAY		13743	C4A	REAL		
13744	C4B	REAL			13741	C5	REAL		
20702	C5AHI	REAL			20701	C5ALO	REAL		
20676	C5BHI	REAL			20675	C5BLO	REAL		
20703	C5EN	REAL			20704	C5MAX	REAL		
20700	C5XHI	REAL			20677	C5XLO	REAL		
13745	C6	REAL			21013	D	REAL		
24160	DB	REAL	ARRAY		21562	DBEL	REAL	ARRAY	
24123	DBMERS	REAL	ARRAY		21076	DBMIN	REAL		
12	DBMOD1	REAL	ARRAY	KARDS	160	DBMOD2	REAL	ARRAY	KARDS
23746	DBRS	REAL	ARRAY		22010	DBSPL	REAL	ARRAY	
23432	DB1A10	REAL	ARRAY		23310	DB1A7D	REAL	ARRAY	
22704	DB1F15	REAL	ARRAY		23026	DB1F16	REAL	ARRAY	
22562	DB1F4	REAL	ARRAY		23166	DB1111	REAL	ARRAY	
23503	DB2A10	REAL	ARRAY		23361	DB2A7D	REAL	ARRAY	
22755	DB2F15	REAL	ARRAY		23115	DB2F16	REAL	ARRAY	
22633	DB2F4	REAL	ARRAY		23237	DB2111	REAL	ARRAY	
22504	DBPVAL	REAL	ARRAY		21334	DECREL	REAL	ARRAY	
13727	DELDDB	REAL			21022	DELRS	REAL		
20775	DELTAB	REAL			20774	DELTAZ	REAL		
21031	DELWE	REAL			21032	DELWS	REAL		
20750	DF	REAL			21105	DNCRM	REAL		
13723	DWE1K	REAL			13721	DWE100	REAL		
13725	DWEEK	REAL			13715	DXC1A	REAL		
13714	DXMERS	REAL			11	DXMOD1	REAL		KARDS
157	DXMOD2	REAL		KARDS	14002	DX1A10	REAL		
13776	DX1A7D	REAL			13762	DX1F15	REAL		
13766	DX1F16	REAL			13756	DX1F4	REAL		
13772	DX1111	REAL			14004	DX2A10	REAL		
14000	DX2A7D	REAL			13764	DX2F15	REAL		
13770	DX2F16	REAL			13760	DX2F4	REAL		
13774	DX2111	REAL			21100	DYVAL	REAL		
21060	EC	REAL			20752	ECCAT1	REAL		
20753	ECCAT2	REAL			7	ECMOVE	REAL		KARDS
21017	ECS	REAL			24174	FLX	REAL	ARRAY	
21075	FLXBF	REAL			21101	FLX1	REAL		
21054	FL2FHI	REAL			21053	FL2FLO	REAL		
21072	FMAX	REAL			20602	FMAXGF	REAL		
20600	FMAXHF	REAL			20576	FMAXPF	REAL		
20615	FMFHI	REAL			20614	FMFLO	REAL		
20601	FMINGF	REAL			20577	FMINHF	REAL		
20575	FMINPF	REAL			0	FN	REAL		KARDS
23673	FPRIHF	REAL	ARRAY		21106	FREQ	REAL	ARRAY	
21020	FRQ	REAL			22236	FSPL	REAL	ARRAY	
24200	FZ	REAL	ARRAY		21023	FZHFHI	REAL		
21025	FZHFLO	REAL			21071	FZHI	REAL		
21066	FZLFHI	REAL			21043	FZLFLO	REAL		
21070	FZLO	REAL			21035	FZMFHI	REAL		
21034	FZMFLO	REAL			20776	FZPF	REAL		
2	F2N	REAL		KARDS	0	H	REAL		PPLOTT
24214	HILO	REAL	ARRAY		45	HITE	REAL		PPLOTT
46	HITE1	REAL		PPLOTT	20603	HMAX	REAL		
20745	I	INTEGER			13732	IALUM	INTEGER		
13753	IA10	INTEGER			13752	IA7D	INTEGER		
57	IBLANK	INTEGER		PPLOTT	375	IBUFET	INTEGER		KARDS

PROGRAM VIPRF 74/74 OPT=1 FTN 4.5+414 08/16/77 13.11.28

VARIABLES SN	TYPE		RELOCATION						
20761	ICK	INTEGER			20755	IERROR	INTEGER		
21077	IFIRST	INTEGER			6	IFLITE	INTEGER		PPLOTT
20763	IFN	INTEGER			341	IFNISH	INTEGER		KARDS
13751	IF111	INTEGER			13747	IF15	INTEGER		
13750	IF16	INTEGER			13746	IF4	INTEGER		
22555	IHOLD	INTEGER	ARRAY		20757	II	INTEGER		
337	ILAND	INTEGER		KARDS	10	ILINE1	INTEGER	ARRAY	PPLOTT
324	ILINE2	INTEGER	ARRAY	KARDS	13733	IMAG	INTEGER		
56	INOPLT	INTEGER		PPLOTT	55	IPHASE	INTEGER		PPLOTT
26	IPLANE	INTEGER	ARRAY	PPLOTT	20607	IPLOT	INTEGER		
334	ISANDL	INTEGER		KARDS	13730	ISTEEL	INTEGER		
336	ITAKOF	INTEGER		KARDS	13731	ITITAN	INTEGER		
17	ITITL1	INTEGER	ARRAY	PPLOTT	340	ITURB	INTEGER		KARDS
20762	IX	INTEGER			20760	J	INTEGER		
20746	JFLITE	INTEGER			21041	K	INTEGER		
21042	L	INTEGER			31	LXNAME	INTEGER	ARRAY	PPLOTT
35	LYNAME	INTEGER	ARRAY	PPLOTT	20756	M	INTEGER		
20754	MATERL	INTEGER			13712	NEEZRF	INTEGER		
13715	NG1A	INTEGER			20737	NC3	INTEGER		
13726	NFDP	INTEGER			13713	NMFRS	INTEGER		
10	NMODE1	INTEGER		KARDS	156	NMODE2	INTEGER		KARDS
21073	NETS	INTEGER			20574	NRSVAL	INTEGER		
13722	NWE1K	INTEGER			13720	NWE100	INTEGER		
13724	NWE5K	INTEGER			14001	N1A10	INTEGER		
13775	N1A7D	INTEGER			13771	N1F111	INTEGER		
13761	N1F15	INTEGER			13765	N1F16	INTEGER		
13755	N1F4	INTEGER			14003	N2A10	INTEGER		
13777	N2A7D	INTEGER			13773	N2F111	INTEGER		
13763	N2F15	INTEGER			13767	N2F16	INTEGER		
13757	N2F4	INTEGER			21061	PEAK	REAL		
21000	PEM	REAL			21001	PEMDB	REAL		
13754	PI	REAL			21104	PNORM	REAL		
20772	PSQ	REAL			20766	R	REAL		
20773	REX	REAL			20767	RNORM	REAL		
3	RS	REAL		PPLOTT	20604	RSMAX	REAL		
24021	RSVALS	REAL	ARRAY		21010	SAHI	REAL		
21007	SALO	REAL			21006	SPHI	REAL		
21021	SELO	REAL			21014	SBTED	REAL		
21011	SFELTA	REAL			21015	SEZHI	REAL		
21012	SEZLO	REAL			24210	SIGN	REAL	ARRAY	
24503	SOUND	REAL	ARRAY		21016	SPEAK	REAL		
21005	SXHI	REAL			21004	SXLO	REAL		
20751	T	REAL			20722	TAKAHI	REAL		
20721	TAKALO	REAL			20716	TAKPHI	REAL		
20715	TAKPLO	REAL			20723	TAKMAX	REAL		
20720	TAKXHI	REAL			20717	TAKXLO	REAL		
20734	TBAHI	REAL			20733	TBPHI	REAL		
20735	TBEC	REAL			20736	TBREF	REAL		
47	TICLEN	REAL		PPLOTT	24170	TWOB	REAL	ARRAY	
21074	TWOBRF	REAL			20771	U	REAL		
20764	V	REAL			23572	VALK	REAL	ARRAY	
24600	VISCOS	REAL	ARRAY		20770	VNORM	REAL		
4	WE	REAL		PPLOTT	23554	WEK	REAL	ARRAY	
20605	WEMAX	REAL			24074	WE100	REAL	ARRAY	
24103	WE1000	REAL	ARRAY		24112	WE5000	REAL	ARRAY	
5	WS	REAL		PPLOTT	2	Y	REAL		PPLOTT
44	XAXIS	REAL		PPLOTT	5	XBT	REAL		KARDS

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          PROGRAM VIPRF        74/74    OPT=1                              FTN 4.6+414        08/16/77  13.11.28

VARIABLES        SN   TYPE               RELOCATION
     41   XCYCLE       REAL                   PPLOTT      20747   XL         REAL
  24164   XFERMX       REAL          ARRAY                21033   XHFCCR     REAL
  21027   XHFHI        REAL                               21026   XHFLC      REAL
  21003   XHFMAX       REAL                               21063   XHI        REAL
  13717   XINC1A       REAL                               21040   XLFCCR     REAL
  21050   XLFHI        REAL                               21047   XLFLO      REAL
      1   XLFMAX       REAL                   KARDS       21062   XLO        REAL
  21052   XL2FCP       REAL                               20640   XL2FHI     REAL
  20637   XL2FLC       REAL                                   3   XL2FMX     REAL          KARDS
      1   XMAKNO       REAL                   PPLOTT      21036   XMFCCR     REAL
  20621   XMFHI        REAL                               20620   XMFLC      REAL
  21002   XMFMAX       REAL                               20606   XPF        REAL
      5   XTL          REAL                   KARDS       21103   XVAL       REAL
     54   XX           REAL                   PPLOTT      20625   XXHFHI     REAL
  20624   XXHFLC       REAL                               20613   XXLFHI     REAL
  20612   XXLFLC       REAL                                  50   X1         REAL          PPLOTT
     51   X2           REAL                   PPLOTT         52   X3         REAL          PPLOTT
     53   X4           REAL                   PPLOTT         43   YAXIS      REAL          PPLOTT
     42   YSTEP        REAL                   PPLOTT      21102   YVAL       REAL

FILE NAMES         MODE
      0   INPUT        FMT            2041   OUTPUT      FMT            4102   FLFILE                       0   TAPE5      FMT

EXTERNALS              TYPE    ARGS
          ALOG10       REAL       1  LIBRARY                        ATAN2       REAL        2  LIBRARY
          BASALF                  1                                 BETA                    0
          COMPRS                  0                                 CURVE                   4
          DONEPL                  0                                 ENDPL                   1
          EOF          REAL       1                                 GPCINTS                17
          HEIGHT                  1                                 LOCFPXA                13
          MARKER                  1                                 MIXALF                  1
          ONEFUN                 21                                 QUAD                    6
          READCDS                17                                 RESET                   1
          RLMESS                  4                                 RLREAL                  4
          TFFPLIN                 8                                 TWOFUN                  8
          XFERFUN                13                                 YAXANG                  1
          YINTAX                  0

INLINE FUNCTIONS     TYPE    ARGS
          ABS          REAL       1   INTRIN                        AMOD        REAL        2   INTRIN

STATEMENT LABELS
   6337   1                                 14703   2          FMT                       7141   3
   6445   4                                 14753   5          FMT                      14665   6          FMT
   7120   7                                 14767   8          FMT                       6501   9
   6513   10                                 6577   11                                  7177   12
   7212   13                                 6525   14                                 14014   15          FMT
  14273   16         FMT                        0   17                                  6552   18
   6564   19                                 6414   20                                  7017   21
   7222   22                                 6576   23                                 14360   24          FMT
  14030   25         FMT                     6417   26                                  6464   27
   7100   28                                14163   29         FMT                       7031   30
   6344   31                                 7045   32                                 14054   33          FMT
   7227   34                                 7057   35                                 14072   36          FMT
  14110   37         FMT                    14124   38         FMT                      14147   39          FMT
   6422   40                                 6455   41                                     0   42
   6425   43                                 7241   44                                  7264   45
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PROGRAM VIPRF 74/74 OPT=1 FTN 4.5+414 08/16/77 13.11.28

STATEMENT LABELS

6430	46		6435	47		6433	48	
6637	50		14416	52	FMT	6664	54	
6710	56		6734	58		6676	60	
6746	62		6722	64		6760	66	
6772	68		7004	70		6612	74	
6624	76		7132	78		7320	90	
7340	92		7346	94		7354	96	
7357	100		15060	205	FMT	15104	210	FMT
15156	220	FMT	15164	225	FMT	15246	230	FMT
15255	235	FMT	7463	239		15333	240	FMT
15353	245	FMT	15735	246	FMT	7510	247	
7524	250		15433	251	FMT	7563	252	
7676	253		15523	254	FMT	15607	255	FMT
7622	256		7723	257		15670	260	FMT
7731	280		0	310		7760	315	
7765	320		10015	321		10022	322	
10005	323		10027	325		10043	330	
10050	335		10055	340		10063	350	
10101	351		15454	352	FMT	15737	353	FMT
16054	354	FMT	15770	355	FMT	10136	356	
10150	370		10116	375		16101	380	FMT
16154	382	FMT	15751	383	FMT	16231	385	FMT
10205	387		10321	389		16344	390	FMT
10267	393		10233	395		10357	398	
10367	405		10373	410		10432	415	
16734	420	FMT	16771	425	FMT	10747	427	
10460	431		10514	433		10642	435	
10757	436		11027	437		17006	438	FMT
16577	439	FMT	11036	440		17017	441	FMT
10556	442		10574	443		10605	444	
10667	446		10704	447		10615	448	
10722	449		11506	450		17162	451	FMT
11512	452		0	453		17234	455	FMT
11606	456		11522	457		17111	458	FMT
11365	459		0	460		17220	461	FMT
11421	463		0	465		11467	466	
11451	467		11460	472		11647	473	
11671	475		11677	480		11716	505	
12044	507		11726	508		17252	509	FMT
17271	511	FMT	17304	512	FMT	17341	513	FMT
12135	514		12200	518		12213	520	
17411	521	FMT	11265	580		11320	590	
11074	600		17030	605	FMT	11162	610	
11200	620		11206	625		11235	630	
11251	640		0	770		12222	774	
12265	775		0	780		12276	785	
12300	787		12311	788		12313	789	
17611	790	FMT	12342	793		12344	795	
12361	800		12372	805		12427	810	
12507	820		12513	840		12517	860	
12544	850		17700	900	FMT	0	910	
17751	920	FMT	12526	1000				

LOOPS	LABEL	INDEX	FROM-TO	LENGTH	PROPERTIES
6360		* I	775 775	10B	EXT REFS
6460	42	I	825 826	7B	INSTACK
7060	1000	* I	944 2139	3451B	EXT REFS NOT INNER

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          PROGRAM VIPRE       74/74    OPT=1                           FTN 4.5+414        08/16/77  13.11.28

LCOES   LABEL      INDEX       FROM-TO     LENGTH    PROPERTIES
 7144   17          II          980  982       4B      INSTACK
 7752   710      *  J          1250 1233      6?B      INSTACK     EXITS
11376   465      *  II         1772 1776     233                EXT REFS     EXITS
11423   465      *  IT         1779 1782     23B                EXT REFS
11527   463         K          1839 1841      3B       INSTACK
12245   770         II         2012 2013      3B       INSTACK
12272   780         IT         2022 2023      2B       INSTACK
12550   910      *  I          2157 2160     23B                EXT REFS

COMMON BLOCKS    LENGTH
       PFLOTT        49
       KARDS        225

STATISTICS
  PROGRAM LENGTH                   17617B     7695
  BUFFER LENGTH                     6144B     3172
  CM LABELED COMMON LENGTH           422B      274
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 SUBROUTINE READCDS      74/74    OPT=1                          FTN 4.5+414         08/16/77  13.11.28

          SUBROUTINE READCDS(ZFN,ZLFMAX,ZF2N,ZL2FMX,ZBUFMX,ZXBT,ZXTL,            VIPRF     2166
         1ZFCMOV,NOMOD1,DXM1,DBM1,NOMOD2,DXM2,DBM2,ITYPCK,ICRAFT,IERROR)          VIPRF     2167
                                                                                VIPRF     2168
          COMMON/KARDS/FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE,               VIPRF     2169
         1NMODE1,DXMOD1,DBMOD1(100),NMODE2,DXMOD2,DBMOD2(100),                   VIPRF     2170
         2ILINE2(8),ISANEL,IBUFET,ITAKOF,ILAND,ITURB,IFNISH                      VIPRF     2171
                                                                                VIPRF     2172
          DIMENSION DBM1(1),DBM2(1),IDATA(8)                                     VIPRF     2173
                                                                                VIPRF     2174
          DATA IBLANK/1H /                                                      VIPRF     2175
                                                                                VIPRF     2176
          IERROR=0                                                              VIPRF     2177
                                                                                VIPRF     2178
C        *************************                                              VIPRF     2179
C        *                       *                                              VIPRF     2180
C        READ INPUT DATA CARD 4                                                 VIPRF     2181
C        *                       *                                              VIPRF     2182
C        *************************                                              VIPRF     2183
          READ(5,20) ILINE2                                                     VIPRF     2184
       20 FORMAT(8A10)                                                          VIPRF     2185
                                                                                VIPRF     2186
                                                                                VIPRF     2187
C         CHECK WHETHER "END-OF-JOB" CARD WAS READ                              VIPRF     2188
                                                                                VIPRF     2189
          IF(EOF(5).EQ.0) GO TO 110                                             VIPRF     2190
                                                                                VIPRF     2191
          PRINT 40                                                              VIPRF     2192
       40 FORMAT(1H-,28X,*THE END-OF-JOB CARD WAS ENCOUNTERED INSTEAD OF THE    VIPRF     2193
         1 EXPECTED*)                                                           VIPRF     2194
          PRINT 43                                                              VIPRF     2195
       43 FORMAT(29X,*PROFILE PARAMETERS-SPECIAL VALUES CARD.*)                 VIPRF     2196
                                                                                VIPRF     2197
          IF(ITYPCK.EQ.1) GO TO 50                                              VIPRF     2198
                                                                                VIPRF     2199
          PRINT 45                                                              VIPRF     2200
       45 FORMAT(29X,*PROGRAM EXECUTION STOPS BECAUSE*)                         VIPRF     2201
          PRINT 47                                                              VIPRF     2202
       47 FORMAT(29X,*INPUT DATA VALUES ARE NOT STORED IN THE PROGRAM FOR TH    VIPRF     2203
         1E SPECIFIED TYPE OF AIRCRAFT*/29X,*VALUES ARE STORED ONLY FOR THE     VIPRF     2204
         2TYPES F-4,F-15,F-16,F-111,A-10 AND A-7D AIRCRAFT.*)                   VIPRF     2205
          CALL ECNFEL                                                           VIPRF     2206
          STOP                                                                  VIPRF     2207
                                                                                VIPRF     2208
       50 IERROR=4 $PRINT 60                                                    VIPRF     2209
       60 FORMAT(                                                               VIPRF     2210
         11H-,28X,     *PROGRAM EXECUTION PROCEEDS ASSUMING THAT A BLANK "PROF  VIPRF     2211
         1ILE PARAMETERS-SPECIAL VALUES" CARD*/29X,*THEN A "FINISH" CARD SHO    VIPRF     2212
         2ULD HAVE FOLLOWED THE "AIRCRAFT PARAMETERS" CARD.*)                   VIPRF     2213
                                                                                VIPRF     2214
       65 FN=ZFN $XLFMAX=ZLFMAX $F2N=ZF2N $XL2FMX=ZL2FMX $BUFMAX=ZBUFMX         VIPRF     2215
          XBT=ZXBT $XTL=ZXTL $FCMOVE=ZFCMOV                                     VIPRF     2216
          PRINT 67,FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE                   VIPRF     2217
       67 FORMAT(1H-,28X,*PROFILE PARAMETERS-SPECIAL VALUES,INPUT DATA VALUE    VIPRF     2218
         1S STORED IN PROGRAM*/29X,8F10.1)                                      VIPRF     2219
                                                                                VIPRF     2220
       70 NMODE1=NOMOD1 $DXMOD1=DXM1                                            VIPRF     2221
          DO 80 I=1,NMODE1                                                      VIPRF     2222
```

```
SUBROUTINE READCDS     74/74    OPT=1                    FTN 4.5+414        08/16/77  13.11.28

80  DBMOD1(I)=DBM1(I)
    J=6HFIRST  $PRINT 85,J,NMODE1,DXMOD1,(DBMOD1(I),I=1,NMODE1)
85  FORMAT(1H0,28X,A6,* BENDING MODE VALUES,INPUT DATA VALUES STORED I
   1N PROGRAM*/29X,I2,13F6.2/(29X,13F6.2))
90  IF(E2N.NE.0.) GO TO 100
    PRINT 92
92  FORMAT(1H-,28X,*SECOND BENDING MODE VALUES WILL NOT BE USED IN PRO
   1GRAM CALCULATIONS*/29X,*BECAUSE E   =0.*/38X,*2N*)
    RETURN
100 NMODE2=NCMODE2 $DXMOD2=DXM2
    DO 105 I=1,NMODE2
105 DBMOD2(I)=DBM2(I)
    J=6HSECOND $PRINT 85,J,NMODE2,DXMOD2,(DBMOD2(I),I=1,NMODE2)
    RETURN
C       CHECK WHETHER "FINISH" CARD WAS READ
110 IF(ILINE2(1).NE.IFINISH) GO TO 160
    PRINT 120
120 FORMAT(1H-,28X,*THE "FINISH" CARD WAS ENCOUNTERED INSTEAD OF THE E
   1XPECTED*)
    PRINT 43
    IF(ITYPCK.EQ.1) GO TO 140
    IERROR=1 $PRINT 130
130 FORMAT(29X,*THE PROGRAM PROCEEDS TO THE NEXT SET,IF ANY,OF INPUT D
   1ATA CARDS BECAUSE*)
    PRINT 47 $RETURN
140 PRINT 60 $GO TO 65
C       CHECK WHETHER "DESCRIPTION" CARD WAS READ
160 I=ILINE2(4) $IF(I.NE.ISANDL.AND.I.NE.IBUFFT.AND.I.NE.ITAKOF.AND.
   1I.NE.ILAND.AND.I.NE.ITURB) GO TO 200
    PRINT 180
180 FORMAT(1H-,28X,*THE CARD SHOWN BELOW APPARENTLY IS A "DESCRIPTION"
   1 CARD*/29X,*WHICH WAS ENCOUNTERED INSTEAD OF THE EXPECTED*)
    PRINT 43
    PRINT 185,ILINE2
185 FORMAT(1H0,28X,8A10)
    IF(ITYPCK.EQ.1) GO TO 210
    IERROR=2
    PRINT 190
```

SUBROUTINE READCDS   74/74   OPT=1   FTN 4.5+414   08/16/77 13.11.28

```
          190 FORMAT(1H-,28X,*IT IS ASSUMED THAT THIS APPARENT "DESCRIPTION" CAR
             1D*/29X,*BELONGS TO THE NEXT SET,IF ANY,OF INPUT DATA CARDS.*/
             229X,*AND THE PROGRAM PROCEEDS TO THIS SET.*)
              RETURN

          210 IERROR=3 $PRINT 60 $PRINT 200
          200 FORMAT(29X,*IT ALSO IS ASSUMED THAT THIS APPARENT "DESCRIPTION" CA
             1RD*/29X,*BELONGS TO THE NEXT SET,IF ANY, OF INPUT DATA CARDS.*)
              GO TO 65


      C       CHECK VALUE IN CARD COLUMNS 75-80

          203 ENCODE(10,205,I) ILINE2(8)
          205 FORMAT(R6)
              DECODE(10,207,I) YFCMOV
          207 FORMAT(F6.2)
              IF(YFCMOV.GE.0.) GO TO 220


      C       CARD IS ASSUMED TO BE CARD 1 OF THE SET OF 1ST BENDING MODE VAL. C

              PRINT 217
          217 FORMAT(1H-,28X,*THE CARD SHOWN BELOW APPARENTLY IS CARD 1 OF THE S
             1ET OF*/29X,*1ST BENDING MODE VALUE CARDS INSTEAD OF THE EXPECTED*)
              PRINT 43 $PRINT 165,ILINE2

              IF(ITYPCK.EQ.1) GO TO 213

              PRINT 45 $PRINT 47
              CALL DCNEPL $STOP

          213 PRINT 215
          215 FORMAT(1H-,28X,*PROGRAM EXECUTION PROCEEDS ASSUMING THAT A BLANK "
             1PROFILE PARAMETERS-SPECIAL VALUES" CARD*/29X,*SHOULD HAVE PRECEDE
             2D THIS CARD.*)

              FN=ZFN $XLFMAX=ZLFMAX $F2N=ZF2N $XL2FMX=ZL2FMX $BUFMAX=ZBUFMX
              XBT=ZXBT $XTL=ZXTL $FCMOVE=ZFCMOV

              PRINT 260,FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE

              NCARDS=1 $NMODE=5HFIRST $IMODCK=1
              GO TO 570


      C       CARD IS ASSUMED TO BE THE "PROFILE PARAMETERS-SPECIAL VALUES" CARD

          220 IF(ITYPCK.EQ.1) GO TO 230

              DECODE(80,225,ILINE2) FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE
          225 FORMAT(8F10.3)
              PRINT 227,ILINE2
          227 FORMAT(1H-,28X,*PROFILE PARAMETERS-SPECIAL VALUES CARD*/29X,8A10)
              GO TO 298

          230 FN=ZFN $XLFMAX=ZLFMAX $F2N=ZF2N $XL2FMX=ZL2FMX $BUFMAX=ZBUFMX
```

```
      XBT=ZXBT $XTL=ZXTL $FCMOVE=ZFCMOV

      J=1H

      DO 240 I=1,8
      IF(ILINE2(I).NE.J) GO TO 270
  240 CONTINUE


      PRINT 260,FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE
  260 FORMAT(1H0,28X,*PROFILE PARAMETERS-SPECIAL VALUES CARD,INPUT DATA
     1VALUES STORED IN PROGRAM(A BLANK CARD WAS READ)*/
     229X,8F10.1)
      GO TO 298


  270 DECODE(80,225,ILINE2) YFN,YLFMAX,YF2N,YL2FMX,YBUFMX,YXBT,YXTL,
     1YFCMOV

      J=8H       *
      DO 277 I=1,8
  277 IDATA(I)=1H

      IF(YFN.EQ.0.) GO TO 280
      FN=YFN $IDATA(1)=J
  280 IF(YLFMAX.EQ.0.) GO TO 282
      XLFMAX=YLFMAX $IDATA(2)=J
  282 IF(YF2N.EQ.0.) GO TO 284
      F2N=YF2N $IDATA(3)=J
  284 IF(YL2FMX.EQ.0.) GO TO 286
      XL2FMX=YL2FMX $IDATA(4)=J
  286 IF(YBUFMX.EQ.0.) GO TO 288
      BUFMAX=YBUFMX $IDATA(5)=J
  288 IF(YXBT.EQ.0.) GO TO 290
      XBT=YXBT $IDATA(6)=J
  290 IF(YXTL.EQ.0.) GO TO 292
      XTL=YXTL $IDATA(7)=J
  292 IF(YFCMOV.EQ.0.) GO TO 294
      FCMOVE=YFCMOV $IDATA(8)=J

  294 PRINT 296,FN,XLFMAX,F2N,XL2FMX,BUFMAX,XBT,XTL,FCMOVE,IDATA
  296 FORMAT(1H-,28X,*PROFILE PARAMETERS-SPECIAL VALUES CARD,INPUT DATA
     1VALUES READ FROM CARD OR STORED IN PROGRAM*/ 29X,8F10.1/29X,8A10/
     229X,32H* INDICATES VALUE READ FROM CARD )


  298 NCARDS=1 $NMODE=5HFIRST $IMODCK=1

C     *************************
C     *                       *
C      READ FIRST CARD IN SET
C      OF PENDING MODE VALUE CARDS
C     *                       *
C     *************************
  300 READ(5,20) ILINE2
```

SUBROUTINE READCDS   74/74   OPT=1   FTN 4.5+414   08/16/77 13.11.28

```
C     CHECK WHETHER "END-OF-JOB" CARD WAS READ

      IF(EOF(5).EQ.0) GO TO 430

      IERROR=4 $PRINT 40
      IF(IMODCK.EQ.2) GO TO 350

      PRINT 310,NCARDS,NMODE
  310 FORMAT(29X,*CARD *,I1,* OF THE SET OF "*,A6,* BENDING MODE VALUE"C
     1ARDS *,2A10)

      IF(ITYPCK.EQ.1) GO TO 320

      PRINT 45 $PRINT 47
      CALL DONEPL $STOP

  320 I=10HOR THE FIN $J=8HISH CARD $PRINT 330,I,J
  330 FORMAT(29X,8A10)
      PRINT 340 $PRINT 43
  340 FORMAT(1H0,28X,*PROGRAM EXECUTION PROCEEDS ASSUMING THAT THE "FINI
     1SH" CARD FOLLOWED THE*/29X,8A10)
      GO TO 70


  350 IF(F2N.NE.0.) GO TO 380

      I=10HFINISH CAR $J=1HD $PRINT 330,I,J
      PRINT 360
  360 FORMAT(29X,*PROGRAM EXECUTION PROCEEDS ASSUMING THAT THE "FINISH"
     1CARD SHOULD HAVE FOLLOWED*)
      PRINT 370
  370 FORMAT(29X,*THE PRECEEDING SET OF BENDING MODE VALUE CARDS.*)
      PRINT 92
      RETURN

  380 IF(ITYPCK.EQ.1) GO TO 390

      PRINT 45 $PRINT 47
      CALL DONEPL $STOP

  390 I=10HOR THE FIN $J=8HISH CARD $PRINT 310,NCARDS,NMODE,I,J
      PRINT 360 $PRINT 370
      GO TO 90


      CHECK WHETHER "FINISH" CARD WAS READ

  430 IF(ILINE2(1).NE.IFINISH) GO TO 450

      IF(IMODCK.EQ.2) GO TO 440

      IF(ITYPCK.EQ.1) GO TO 70

      IERROR=1
      PRINT 120 $PRINT 310,NCARDS,NMODE
```

SUBROUTINE READCDS 74/74 OPT=1 FTN 4.5+414 08/16/77 13.11.28

```
      PRINT 47 $PRINT 435
  435 FORMAT(29X,*THE PROGRAM PROCEEDS TO THE NEXT SET,IF ANY,OF DATA CA
     1RDS.*)
      RETURN

  440 IF(ITYPCK.EQ.1) GO TO 90

      IF(F2N.EQ.0.) RETURN

      IERROR=1
      PRINT 120 $PRINT 310,NCARDS,NMODE
      PRINT 47 $PRINT 435
      RETURN


C     CHECK WHETHER "DESCRIPTION" CARD WAS READ

  450 I=ILINE2(4) $IF(I.NE.ISANDL.AND.I.NE.IPUFET.AND.I.NE.ITAKOF.AND.
     1I.NE.ILAND.AND.I.NE.ITURB) GO TO 540

      PRINT 190

      IF(IMODCK.EQ.2) GO TO 470

      IF(ITYPCK.EQ.1) GO TO 460

      IERROR=2 $PRINT 310,NCARDS,NMODE
      PRINT 185,ILINE2 $PRINT 47 $PRINT 190
      RETURN

  460 IERROR=3
      I=10HCRD THE FIN $J=8HISH CARD $PRINT 310,NCARDS,NMODE,I,J
      PRINT 185,ILINE2 $PRINT 340 $PRINT 43 $PRINT 200
      GO TO 70


  470 IERROR=3 $IF(ITYPCK.EQ.1) GO TO 500

      IF(F2N.NE.0.) GO TO 490

      I=10HFINISH CAR $J=1HD $PRINT 330,I,J
      PRINT 360 $PRINT 370
      PRINT 92 $PRINT 200
      RETURN

  490 IERROR=2
      PRINT 310,NCARDS,NMODE
      PRINT 185,ILINE2 $PRINT 47 $PRINT 495
  495 FORMAT(29X,*PROGRAM EXECUTION PROCEEDS ASSUMING THAT THIS APPARENT
     1 "DESCRIPTION" CARD*/29X,*BELONGS TO THE NEXT SET,IF ANY,OF INPUT
     2 DATA CARDS.*)
      RETURN

  500 I=10HCRD THE FIN $J=8HISH CARD $PRINT 310,NCARDS,NMODE,I,J
      PRINT 185,ILINE2 $PRINT 360 $PRINT 370 $PRINT 200
      GO TO 90
```

```
  541 DO 543 I=1,8
      IF(ILINE2(I).NE.IBLANK) GO TO 570
  543 CONTINUE

C     A BLANK CARD WAS READ

      IF(ITYPCK.EQ.1) GO TO 553

      IF(IMODCK.EQ.2) GO TO 547

      PRINT 545
  545 FORMAT(1H-,28X,*A BLANK CARD WAS READ INSTEAD OF THE EXPECTED*)
      PRINT 310,NCARDS,NMODE $PRINT 45 $PRINT 47
      CALL CONREL $STOP

  547 IF(F2N.NE.0.) GO TO 550

      PRINT 92
      RETURN

  550 PRINT 545
      I=10HOF THE FIN $J=8HISH CARD $PRINT 310,NCARDS,NMODE,I,J
      PRINT 45 $PRINT 47
      CALL CONREL $STOP

  553 IF(IMODCK.EQ.2) GO TO 557

      NMODE1=NCMOD1 $DXMOD1=DXM1
      DO 555 I=1,NMODE1
  555 DBMOD1(I)=DBM1(I)

      J=5HFIRST $PRINT 85,J,NMODE1,DXMOD1,(DBMOD1(I),I=1,NMODE1)
      GO TO 510

  557 IF(F2N.NE.0.) GO TO 563

      PRINT 92
      RETURN

  563 NMODE2=NCMOD2 $DXMOD2=DXM2
      DO 565 I=1,NMODE2
  565 DBMOD2(I)=DBM2(I)

      J=6HSECOND $PRINT 85,J,NMODE2,DXMOD2,(DBMOD2(I),I=1,NMODE2)
      GO TO 820

C     CARD IS ASSUMED TO BE CARD 1 OF THE SET OF 1ST BENDING MODE VALUE

  570 IF(IMODCK.EQ.2) GO TO 575

      DECODE(80,580,ILINE2) NMODE1,DXMOD1,(DBMOD1(I),I=1,12)
      NVALS=NMODE1 $GO TO 590
```

```
SUBROUTINE READCDS     74/74    OPT=1                    FTN 4.5+414        08/16/77  13.11.28

  575 DECODE(80,580,ILINE2) NMODE2,DXMOD2,(DBMOD2(I),I=1,12)
  580 FORMAT(I2,13F6.2)
      NVALS=NMODE2

  590 PRINT 600,NMODE,ILINE2
  600 FORMAT(1H0,28X,A6,* BENDING MODE VALUE CARDS*/29X,8A10)
      IF(NVALS.LE.12) GO TO 800

      J=13 $K=25 $L=0 $IF(K.LT.NVALS) GO TO 620
      K=NVALS $L=1


C    ************************
C    *                      *
C     READ 2ND AND SUCCEEDING
C     BENDING MODE VALUE CARDS
C    *                      *
C    ************************

  620 NCARDS=NCARDS+1
      READ(5,20) ILINE2

C      CHECK WHETHER "END-OF-JOB" CARD WAS READ

      IF(EOF(5).EQ.0) GO TO 650

      PRINT 40 $PRINT 310,NCARDS,NMODE
      PRINT 45 $PRINT 630,NVALS,NMODE
  630 FORMAT(29X,*ALL OF THE *,I3,* *,A6,* BENDING MODE VALUES COULD NOT
     1 BE READ FROM INPUT DATA CARDS.*)
      CALL DONEPL $STOP

C      CHECK WHETHER "FINISH" CARD WAS READ

  650 IF(ILINE2(1).NE.IFINISH) GO TO 670

      IERROR=1
      PRINT 120 $PRINT 310,NCARDS,NMODE
      PRINT 130 $PRINT 630,NVALS,NMODE
      RETURN

C      CHECK WHETHER "DESCRIPTION" CARD WAS READ

  670 I=ILINE2(4) $IF(I.NE.ISANDL.AND.I.NE.IBUFET.AND.I.NE.ITAKOF.AND.
     1I.NE.ILAND.AND.I.NE.ITURN) GO TO 690

      IERROR=2
      PRINT 180 $PRINT 310,NCARDS,NMODE
      PRINT 185,ILINE2 $PRINT 190
      RETURN

  690 DO 720 I=1,8
      IF(ILINE2(I).NE.IBLANK) GO TO 740
```

```
  700 CONTINUE
C
C     A BLANK CARD WAS READ
C
      PRINT 710
  710 FORMAT(1H-,28X,*A BLANK CARD WAS ENCOUNTERED INSTEAD OF THE EXPECT
     1ED*)
      PRINT 310,NCARDS,NMODE
      PRINT 45 $PRINT 630,NVALS,NMODE
      CALL DCNEEL $STOP
C
C     CARD IS ASSUMED TO BE A MODE VALUE CARD
C
  740 IF(IMCDCK.EQ.1) DECODE(80,760,ILINE2) (DBMOD1(I),I=J,K)
      IF(IMCDCK.EQ.2) DECODE(80,760,ILINE2) (DBMOD2(I),I=J,K)
  760 FORMAT(13F6.2)
C
      PRINT 780,ILINE2
  780 FORMAT(29X,8A10)
C
      IF(L.EQ.1) GO TO 800
C
      J=J+13 $K=K+13 $IF(K.LT.NVALS) GO TO 620
      K=NVALS $L=1
      GO TO 620
C
  800 IF(IMCDCK.EQ.2) GO TO 820
  810 IMCDCK=2 $NCARDS=1 $NMODE=6HSECOND
      GO TO 300
C
C     *************************
C     *                       *
C      READ LAST CARD
C      IN SET OF DATA CARDS
C     *                       *
C     *************************
C
  820 READ(5,20) ILINE2
C
C     CHECK WHETHER "END-OF-JOB" CARD WAS READ
C
      IF(EOF(5).EQ.0) GO TO 860
C
      IERROR=4
      PRINT 40 $I=10HFINISH CAR $J=1HD $PRINT 330,I,J $PRINT 840
  840 FORMAT(29X,*PROGRAM EXECUTION STOPS AFTER THE CURRENT SET OF INPUT
     1 DATA CARDS.*)
      RETURN
C
C     CHECK WHETHER "FINISH" CARD WAS READ
```

```
      SUBROUTINE READCDS     74/74    OPT=1                          FTN 4.5+414        08/16/77  13.11.28

                   860  IF(ILINE2(1).NE.IFINISH) GO TO 870                          VIPRF      2679
  515                                                                               VIPRF      2680
                        PRINT 185,ILINE2                                            VIPRF      2681
                        RETURN                                                      VIPRF      2682
                                                                                    VIPRF      2683
                                                                                    VIPRF      2684
  520             C     CHECK WHETHER "DESCRIPTION" CARD WAS READ                   VIPRF      2685
                                                                                    VIPRF      2686
                    870 I=ILINE2(4) $IF(I.NE.ISANDL.AND.I.NE.IBUFET.AND.I.NE.ITAKOF.AND.   VIPRF      2687
                       1I.NE.ILAND.AND.I.NE.ITURB) GO TO 880                        VIPRF      2688
                                                                                    VIPRF      2689
  525                   IERROR=3                                                    VIPRF      2690
                        PRINT 185 $I=1OHFINISH CAR $J=1HD $PRINT 330,I,J            VIPRF      2691
                        PRINT 185,ILINE2 $PRINT 495                                 VIPRF      2692
                        RETURN                                                      VIPRF      2693
                                                                                    VIPRF      2694
  530                                                                               VIPRF      2695
                  C     A CARD WITH UNKNOWN CONTENTS WAS READ                       VIPRF      2696
                                                                                    VIPRF      2697
                   880  IERROR=4                                                    VIPRF      2698
                        PRINT 900,ILINE2                                            VIPRF      2699
  535              900  FORMAT(1H-,28X,*INSTEAD OF THE EXPECTED "FINISH" CARD,THE CARD SHO VIPRF      2700
                       1WN BELOW WAS ENCOUNTERED AFTER THE */29X,*LAST CARD IN THE SET OF   VIPRF      2701
                       2"SECOND BENDING MODE VALUE" CARDS.*/29X,*PROGRAM EXECUTION STOPS A VIPRF      2702
                       3FTER OUTPUT AND PLOTS ARE PRODUCED FOR THE CURRENT SET OF INPUT DA VIPRF      2703
                       4TA CARDS.*//29X,8A10)                                       VIPRF      2704
  540                   RETURN                                                      VIPRF      2705
                        END                                                         VIPRF      2706
```

```
      SYMBOLIC REFERENCE MAP  (R=1)

ENTRY POINTS
     3  READCDS

VARIABLES       SN    TYPE              RELOCATION
     4   BLEMAX       REAL                  KARDS         12   DBMOD1      REAL        ARRAY      KARDS
   160   DBMOD2       REAL       ARRAY      KARDS          0   DBM1        REAL        ARRAY       F.P.
     0   DBM2         REAL       ARRAY       F.P.         11   DXMOD1      REAL                   KARDS
   157   DXMOD2       REAL                  KARDS          0   DXM1        REAL                    F.P.
     0   DXM2         REAL                   F.P.          7   ECMOVE      REAL                   KARDS
     0   EN           REAL                  KARDS          2   E2N         REAL                   KARDS
  3045   I            INTEGER                           1200   IBLANK      INTEGER
   335   IBUFET       INTEGER               KARDS          0   ICRAFT      INTEGER     *UNUSED     F.P.
  3065   IDATA        INTEGER    ARRAY                     0   IERROR      INTEGER                 F.P.
   341   IFINISH      INTEGER               KARDS        337   ILAND       INTEGER                KARDS
   324   ILINE2       INTEGER    ARRAY      KARDS       3052   IMODCK      INTEGER
   334   ISANDL       INTEGER               KARDS        336   ITAKOF      INTEGER                KARDS
   340   ITURB        INTEGER               KARDS          0   ITYPCK      INTEGER                 F.P.
  3046   J            INTEGER                           3063   K           INTEGER
  3064   L            INTEGER                           3050   NCARDS      INTEGER
  3051   NMODE        INTEGER                             10   NMODE1      INTEGER                KARDS
   156   NMODE2       INTEGER               KARDS          0   NOMOD1      INTEGER                 F.P.
     0   NOMOD2       INTEGER                F.P.       3062   NVALS       INTEGER
```

```
     SUBROUTINE READCDS     74/74    OPT=1                                          FTN 4.5+414        08/16/77  13.11.28

VARIABLES       SN  TYPE               RELOCATION
    5  XPT          REAL                   KARDS          1  XLFMAX    REAL                 KARDS
    3  XL2FMX       REAL                   KARDS          6  XTL       REAL                 KARDS
 3057  YEUFMX       REAL                               3047  YFCMOV    REAL
 3053  YFN          REAL                               3055  YF2N      REAL
 3054  YLFMAX       REAL                               3056  YL2FMX    REAL
 3060  YXPT         REAL                               3061  YXTL      REAL
    0  ZFUFMX       REAL                   F.P.           0  ZFCMOV    REAL                 F.P.
    0  ZFN          REAL                   F.P.           0  ZF2N      REAL                 F.P.
    0  ZLFMAX       REAL                   F.P.           0  ZL2FMX    REAL                 F.P.
    0  ZXPT         REAL                   F.P.           0  ZXTL      REAL                 F.P.

FILE NAMES          MODE
      OUTPUT        FMT                    TAPE5      FMT

EXTERNALS              TYPE    ARGS
      DCNEPL                     0                         EOF        REAL       1

STATEMENT LABELS
 1206   20       FMT                 1213   40      FMT                1227   43      FMT
 1240   45       FMT                 1250   47      FMT                  26   50
 1276   60       FMT                   31   65                         1335   67      FMT
   50   70                              0   80                         1357   85      FMT
   70   90                           1375   92      FMT                  74  100
    0  105                            115  110                         1424  120      FMT
 1442  130       FMT                  133  140                          136  160
 1464  180       FMT                 1510  185      FMT                1516  190      FMT
 1546  200       FMT                  172  203                         1571  205      FMT
 1600  207       FMT                  164  210                          215  213
 1643  215       FMT                 1605  217      FMT                 242  220
 1712  225       FMT                 1720  227      FMT                 251  230
    0  240                           1742  260      FMT                 277  270
    0  277                            314  280                          317  282
  322  284                            325  286                          330  288
  373  290                            336  292                          341  294
 2017  296       FMT                  343  299                          346  300
 2046  310       FMT                  372  320                         2072  330      FMT
 2102  340       FMT                  403  350                         2125  360      FMT
 2142  370       FMT                  417  380                          427  390
  440  430                           2215  435      FMT                 460  440
  475  450                            527  460                          546  470
  570  490                           2351  495      FMT                 602  500
  617  540                              0  543                         2420  545      FMT
  642  547                            646  550                          662  553
    0  555                            705  557                          711  563
    0  565                            732  570                          740  575
 2524  580       FMT                  744  590                         2534  600      FMT
  756  620                           2567  630      FMT                 775  650
 1011  670                           1036  690                            0  700
 2644  710       FMT                 1055  740                         2703  760      FMT
 2711  780       FMT                 1111  800                         1113  810
 1117  820                           2733  840      FMT                1136  860
 1143  870                           1172  880                         2773  900      FMT

LOOPS   LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
   57   80         I          57  58       28        INSTACK
  103  105         I          72  73       28        INSTACK
  270  240      *  I         176 178       58        INSTACK     EXITS
```

```
      SUBROUTINE REARCDS      74/74    OPT=1                                FTN 4.5+414          08/16/77  13.11.28

LOOPS  LABEL      INDEX        FROM-TO      LENGTH      PROPERTIES
  305  277          I            192  193       3B        INSTACK
  620  543      *   I            345  347       5B        INSTACK       EXITS
  673  555          I            375  376       2B        INSTACK
  720  565          I            387  388       2B        INSTACK
 1037  700      *   I            455  457       5B        INSTACK       EXITS

COMMON BLOCKS    LENGTH
      KARDS        226

STATISTICS
  PROGRAM LENGTH                   3075B      1597
  CM LABELED COMMON LENGTH          342B       226
```

SUBROUTINE ONEFUN   74/74   OPT=1   FTN 4.5+414   08/16/77 13.11.28

```
      SUBROUTINE ONEFUN(FREQ,DB,N,PEAK,BLO,BHI,XLO,XHI,FZROLO,FZROHI,
     1ALO,AHI,FMIN,FMAX,DBMIN,ISETZ,IFIRST,LPEAK,IFUN,ISCRPT,ILOHI)
      DIMENSION FREQ(1),DB(1)

      COMMON/PFLCTT/H,XMAKNO,X,RS,WE,WS,IFLITE,CATGRY,ILINE1(7),
     1ITITL1(7),IPLANE(3),LXNAME(4),LYNAME(4),XCYCLE,YSTEP,YAXIS,
     2XAXIS,HITE,HITE1,TICLEN,X1,X2,X3,X4,XX,IPHASE,INOPLT,IBLANK

      DATA IHI/2HHI/,IX/5H (E)$/


      IF(INOPLT.EQ.IBLANK) GO TO 15

      IF(ILOHI.EQ.IHI) GO TO 5

      PRINT 1,IPLANE,IFLITE,IFUN,ISCRPT,BLO,BHI,XLO,XHI,FZROLO,FZROHI,
     1ALO,AHI,PEAK
    1 FORMAT(1H1,8H********,3A10,1H,,A10,8H********///* PARAMETERS OF *
     1A5/17X,A2//8X,*B =*,G11.3/8X,*B'=*,G11.3/
     28X,*X =*,G11.3/8X,*X'=*,G11.3/8X,*F =*,G11.5/9X,*0*/
     38X,*F'=*,G11.5/9X,*0*/4X,*ALPHA =*,G11.3/4X,*ALPHA'=*,G11.3/
     42X,*MAX.VAL.=*,G11.4)
      GO TO 15

    5 PRINT 10,IPLANE,IFLITE,IFUN,ISCRPT,BHI,XHI,FZROHI,AHI,PEAK
   10 FORMAT(1H1,8H********,3A10,1H,,A10,8H********///* PARAMETERS OF *
     1A5/17X,A2//8X,*B'=*,G11.3/8X,*X'=*,F7.3/
     28X,*F'=*,G11.5/9X,*0*/4X,*ALPHA'=*,G11.4/2X,*MAX.VAL.=*,G11.4)


   15 CALL XFERFUN(FREQ,DB,N,PEAK,XLO,XHI,BLO,BHI,FZROLO,FZROHI,ALO,AHI,
     1ILOHI)


      IF(ISETZ.EQ.0) GO TO 40
      DO 20 I=1,N
      IF(DB(I).GE.0.) GO TO 40
   20 DB(I)=0.


   40 IF(INOPLT.EQ.IBLANK) RETURN
      XAXIS=ALOG10(FMAX/FMIN)*XCYCLE
      CALL TITLE(1H ,1,LXNAME,+100,LYNAME,+100,XAXIS,YAXIS)

      CALL HEIGHT(HITE)
      CALL HEADIN(ILINE1,+100,2,3)
      CALL HEADIN(ITITL1,+100,2,3)
      CALL RESET("BASALF")
      CALL HEADIN(IPLANE,+30,2,3)
      CALL BASALF("L/CSTD")
      CALL YTICKS(5)

      XX=PEAK $CALL DBELMAX(XX,YSTEP,DBMAX) $DBMIN=DBMAX-40.0
      CALL XLOG(FMIN,XCYCLE,DBMIN,YSTEP)
      CALL TICKMK(TICLEN,FMAX,YSTEP,YAXIS,DBMIN)

      IFIRST=0
```

```
SUBROUTINE ONEFUN      74/74    OPT=1                    FTN 4.5+414         08/16/77  13.11.28

            DO 60 I=1,N
            IFIRST=IFIRST+1 $IF(DB(IFIRST).GE.DBMIN) GO TO 80
         60 CONTINUE

         80 K=0
            DO 100 I=IFIRST,N
            IF(DB(I).LT.DBMIN) GO TO 120
        100 K=K+1

        120 CALL TABLE(FREQ(IFIRST),DB(IFIRST),K,IFUN,ISCRPT)
            CALL CURVE(FREQ(IFIRST),DB(IFIRST),K,0)

            CALL HEIGHT(HITE1)
            X1=1.10*FMIN $X2=PEAK+0.5
            CALL RLMESS(LPEAK,+100,X1,X2)
            CALL RLREAL(PEAK,+1,"ABUT","ABUT")
            CALL RLMESS(" D(3)$",+100,"ABUT","ABUT")
            CALL HEIGHT(0.5*HITE1)
            CALL RLMESS("  (M)$",+100,X1,X2-0.5)


            DYVAL=1.5*HITE*YSTEP $CALL HEIGHT(HITE1)

            X1=3.14159265-ATAN2(2.0*BHI*(XHI**AHI),1.0-XHI*XHI)
            YVAL=PEAK+20.0*ALOG10(3.14159265/(2.0*X1))
            CALL CURVE(FZROHI,YVAL,1,1)

            IF(ILOHI.EQ.IHI.OR.FZROLO.LT.FMIN) GO TO 140

            X1=ATAN2(2.0*BLO*(XLO**ALO),1.-XLO*XLO)
            YVAL=PEAK+20.0*ALOG10(3.14159265/(2.0*X1))
            CALL CURVE(FZROLO,YVAL,1,1)

        140 CALL LOCFBXA(BLO,BHI,XLO,XHI,FZROLO,FZROHI,ALO,AHI,FMIN,FMAX,
           1YVAL,DYVAL,ILOHI)

            XX=ALOG10(FMAX)-1.10/XCYCLE $XX=10.0**XX
            X1=DBMAX-0.25*YSTEP
            CALL PAPAMS(XX,X1,DYVAL,XMAKNO,H,X,IX,RS,IFLITE,HITE,HITE1)

            RETURN
            END
```

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
3 ONEFUN

VARIABLES SN	TYPE	RELOCATION				
0 AHI	REAL	F.P.	0 ALO	REAL		F.P.
0 BHI	REAL	F.P.	0 BLO	REAL		F.P.
7 CATGRY	REAL	PPLOTT	0 DB	REAL	ARRAY	F.P.
675 DBMAX	REAL		0 DBMIN	REAL		F.P.

```
        SUBROUTINE ONEFUN       74/74    OPT=1                          FTN 4.5+414         08/16/77  13.11.28

 VARIABLES        SN  TYPE             RELOCATION
   677  DYVAL         REAL                                  0  FMAX      REAL                     F.P.
     0  FMIN          REAL                  F.P.            0  FREQ      REAL      ARRAY          F.P.
     0  FZROHI        REAL                  F.P.            0  FZROLO    REAL                     F.P.
     0  H             REAL                  PPLOTT         45  HITE      REAL                     PPLOTT
    46  HITE1         REAL                  PPLOTT        674  I         INTEGER
    57  IBLANK        INTEGER               PPLOTT          0  IFIRST    INTEGER                  F.P.
     6  IFLITE        INTEGER               PPLOTT          0  IFUN      INTEGER                  F.P.
   545  IHI           INTEGER                              10  ILINE1    INTEGER   ARRAY          PPLOTT
     0  ILOHI         INTEGER               F.P.           56  INOPLT    INTEGER                  PPLOTT
    55  IPHASE        INTEGER               PPLOTT         26  IPLANE    INTEGER   ARRAY          PPLOTT
     0  ISCRPT        INTEGER               F.P.            0  ISETZ     INTEGER                  F.P.
    17  ITITL1        INTEGER    ARRAY      PPLOTT        546  IX        INTEGER
   676  K             INTEGER                               0  LPEAK     INTEGER                  F.P.
    31  LXNAME        INTEGER    ARRAY      PPLOTT         35  LYNAME    INTEGER   ARRAY          PPLOTT
     0  N             INTEGER               F.P.            0  PEAK      REAL                     F.P.
     3  RS            REAL                  PPLOTT         47  TICLEN    REAL                     PPLOTT
     4  WE            REAL                  PPLOTT          5  WS        REAL                     PPLOTT
     2  X             REAL                  PPLOTT         44  XAXIS     REAL                     PPLOTT
    41  XCYCLE        REAL                  PPLOTT          0  XHI       REAL                     F.P.
     0  XLO           REAL                  F.P.            1  XMAKNO    REAL                     PPLOTT
    54  XX            REAL                  PPLOTT         50  X1        REAL                     PPLOTT
    51  X2            REAL                  PPLOTT         52  X3        REAL                     PPLOTT
    53  X4            REAL                  PPLOTT         43  YAXIS     REAL                     PPLOTT
    42  YSTEP         REAL                  PPLOTT        700  YVAL      REAL

 FILE NAMES         MODE
        OUTPUT      FMT

 EXTERNALS              TYPE    ARGS
        ALOG10      REAL           1 LIBRARY             ATAN2       REAL         2 LIBRARY
        BASALE                     1                     CURVE                    4
        DEELMAY                    3                     HEADIN                   4
        HEIGHT                     1                     LOCFBXA                 13
        PARAMS                    11                     RESET                    1
        PLMESS                     4                     PLREAL                   4
        TABLE                      5                     TICKMK                   5
        TITLE                      8                     XFERFUN                 13
        XLOG                       4                     YTICKS                   1

 STATEMENT LABELS
   567  1         FMT                     24  5                                634  10        FMT
    26  15                                 0  20                                64  40
     0  50                               147  80                                 0  100
   161  120                              302  140

 LOOPS  LABEL     INDEX     FROM-TO     LENGTH     PROPERTIES
    56  20        * I       36  38        6B        INSTACK    EXITS
   140  60        * I       58  60        7B        INSTACK    EXITS
   152  100       * I       63  65        7B        INSTACK    EXITS

 COMMON BLOCKS    LENGTH
        PPLOTT        48

 STATISTICS
   PROGRAM LENGTH                    1003B       515
   CM LABELED COMMON LENGTH            60B        48
```

```
SUBROUTINE TWCFUN     74/74    OPT=1                         FTN 4.5+414         08/16/77  13.11.28

          SUBROUTINE TWCFUN(FREQ,DB1,DB2,N,FMIN,FMAX,DBMIN,DYVAL)        VIPRF    2806
          DIMENSION FREQ(1),DB1(1),DB2(1)                                 VIPRF    2807
                                                                          VIPRF    2808
          COMMON/PPLOTT/H,XMAKNO,X,RS,WE,WS,IFLITE,CATGRY,ILINE1(7),      VIPRF    2809
         1ITITL1(7),IPLANE(3),LXNAME(4),LYNAME(4),XCYCLE,YSTEP,YAXIS,     VIPRF    2810
         2XAXIS,HITE,HITE1,TICLEN,X1,X2,X3,X4,XX,IPHASE,INOPLT,IBLANK     VIPRF    2811
                                                                          VIPRF    2812
          DATA IX/5H (E)$/                                                VIPRF    2813
                                                                          VIPRF    2814
                                                                          VIPRF    2815
          DBMAX=-1.0E3                                                    VIPRF    2816
          DO 10 I=1,N                                                     VIPRF    2817
          X1=DB1(I) $X2=DB2(I) $X3=X1+X2 $DB2(I)=X3                       VIPRF    2818
          IF(X3.GT.DBMAX) DBMAX=X3 $X3=10.0**(X3/10.)                     VIPRF    2819
          IF(IPHASE.EQ.1) PRINT 20,FREQ(I),X1,X2,DB2(I),X3                VIPRF    2820
       10 CONTINUE                                                        VIPRF    2821
       20 FORMAT(6G18.5)                                                  VIPRF    2822
                                                                          VIPRF    2823
          IF(IPHASE.EQ.0) RETURN                                          VIPRF    2824
                                                                          VIPRF    2825
          DYVAL=1.5*HITE*YSTEP                                            VIPRF    2826
          X1=DBMAX $CALL DBELMAX(X1,YSTEP,DBMAX)                          VIPRF    2827
          DBMIN=DBMAX-40.0 $IF(ABS(X1-DB2(1)).LE.35.0) GO TO 30           VIPRF    2828
          YSTEP=10.0 $DBMIN=DBMAX-80.0 $DYVAL=2.0*DYVAL                   VIPRF    2829
                                                                          VIPRF    2830
       30 XAXIS=ALOG10(FMAX/FMIN)*XCYCLE                                  VIPRF    2831
          CALL TITLE(1H ,1,LXNAME,+100,LYNAME,+100,XAXIS,YAXIS)           VIPRF    2832
                                                                          VIPRF    2833
          CALL HEIGHT(HITE)                                               VIPRF    2834
          CALL HEADIN(ILINE1,+100,2,3)                                    VIPRF    2835
          CALL HEADIN(ITITL1,+100,2,3)                                    VIPRF    2836
          CALL RESET("BASALF")                                            VIPRF    2837
          CALL HEADIN(IPLANE,+30,2,3)                                     VIPRF    2838
          CALL BASALF("L/CSTD")                                           VIPRF    2839
          CALL YTICKS(5)                                                  VIPRF    2840
          CALL XLOG(FMIN,XCYCLE,DBMIN,YSTEP)                              VIPRF    2841
          CALL TICKMK(TICLEN,FMAX,YSTEP,YAXIS,DBMIN)                      VIPRF    2842
                                                                          VIPRF    2843
          DO 40 I=1,N                                                     VIPRF    2844
          IF(DB2(I).LT.DBMIN) DB2(I)=DBMIN                                VIPRF    2845
       40 CONTINUE                                                        VIPRF    2846
                                                                          VIPRF    2847
          CALL CURVE(FREQ,DB2,N,0)                                        VIPRF    2848
                                                                          VIPRF    2849
          X1=ALOG10(FMAX)-1.1/XCYCLE $X1=10.0**X1                         VIPRF    2850
          X2=DBMAX-0.25*YSTEP                                             VIPRF    2851
          CALL PARAMS(X1,X2,DYVAL,XMAKNO,H,X,IX,RS,IFLITE,HITE,HITE1)     VIPRF    2852
          RETURN                                                          VIPRF    2853
          END                                                             VIPRF    2854


SYMBOLIC REFERENCE MAP (R=1)
```

```
      SUBROUTINE TWOFUN      74/74    OPT=1                              FTN 4.5+414          08/16/77  13.11.28

ENTRY POINTS
    3  TWOFUN

VARIABLES       SN  TYPE                 RELOCATION
     7  CATGRY        REAL                  PPLOTT        321   DBMAX       REAL
     0  DBMIN         REAL                    F.P.          0   DB1         REAL         ARRAY        F.P.
     0  DB2           REAL         ARRAY      F.P.          0   DYVAL       REAL                      F.P.
     0  FMAX          REAL                    F.P.          0   FMIN        REAL                      F.P.
     0  FREQ          REAL         ARRAY      F.P.          0   H           REAL                      PPLOTT
    45  HITE          REAL                  PPLOTT         46   HITE1       REAL                      PPLOTT
   322  I             INTEGER                              57   IBLANK      INTEGER                   PPLOTT
     6  IFLITE        INTEGER               PPLOTT         10   ILINE1      INTEGER      ARRAY        PPLOTT
    56  INOPLT        INTEGER               PPLOTT         55   IPHASE      INTEGER                   PPLOTT
    26  IPLANE        INTEGER      ARRAY    PPLOTT         17   ITITL1      INTEGER      ARRAY        PPLOTT
   266  IX            INTEGER                              31   LXNAME      INTEGER      ARRAY        PPLOTT
    35  LYNAME        INTEGER      ARRAY    PPLOTT          0   N           INTEGER                   F.P.
     3  RS            REAL                  PPLOTT         47   TICLEN      REAL                      PPLOTT
     4  WE            REAL                  PPLOTT          5   WS          REAL                      PPLOTT
     2  X             REAL                  PPLOTT         44   XAXIS       REAL                      PPLOTT
    41  XCYCLE        REAL                  PPLOTT          1   XMAKNO      REAL                      PPLOTT
    54  XX            REAL                  PPLOTT         50   X1          REAL                      PPLOTT
    51  X2            REAL                  PPLOTT         52   X3          REAL                      PPLOTT
    53  X4            REAL                  PPLOTT         43   YAXIS       REAL                      PPLOTT
    42  YSTEP         REAL                  PPLOTT

FILE NAMES           MODE
       OUTPUT        FMT

EXTERNALS            TYPE      ARGS
       ALOG10        REAL        1 LIBRARY                  BASALF                1
       CURVE                     4                          DBFLMAX               3
       HEADIN                    6                          HEIGHT                1
       PARAMS                   11                          RESET                 1
       TICKMK                    5                          TITLE                 8
       YLOG                      4                          YTICKS                1

INLINE FUNCTIONS     TYPE      ARGS
       ABS           REAL        1   INTRIN

STATEMENT LABELS
    0  10                                   277   20         FMT                          67   30
    0  40

LOOPS   LABEL      INDEX       FROM-TO     LENGTH     PROPERTIES
   20   10       * I            12 16        25B                   EXT REFS
  135   40         I            39 41        3B        INSTACK

COMMON BLOCKS      LENGTH
       PPLOTT          48

STATISTICS
  PROGRAM LENGTH                     352B        234
  CM LABELED COMMON LENGTH            60B         48
```

```
SUBROUTINE LOGFBXA     74/74    OPT=1                      FTN 4.5+414          08/16/77   13.11.28

          SUBROUTINE LOGFBXA(BLO,BHI,XLO,XHI,FZROLO,FZROHI,ALO,AHI,FMIN,
         1FMAX,YVAL,DYVAL,ILOHI)

          COMMON/PFLOTT/H,XMAKNO,X,RS,WE,WS,IFLITE,CATGRY,ILINE1(7),
         1ITITL1(7),IPLANE(3),LXNAME(4),LYNAME(4),XCYCLE,YSTEP,YAXIS,
         2XAXIS,HITE,HITE1,TICLEN,X1,X2,X3,X4,XX,IPHASE

          DATA IHI/2HHI/

          WIDTH=1.25
          FZLO=FZROLO $IF(FZROLO.LT.FMIN) FZLO=FMIN
          FZHI=FZROHI $IF(FZROHI.GT.FMAX) FZHI=FMAX
          IF(ILOHI.NE.IHI) GO TO 100
          X3=FZHI $X4=FMAX
          DHIMAX=ALOG10(FMAX/FZHI)*XCYCLE $IF(DHIMAX.GE.WIDTH) GO TO 220
          X3=FMIN $X4=FZHI
          GO TO 220

      100 DLOHI=ALOG10(FZHI/FZLO)*XCYCLE $DHIMAX=ALOG10(FMAX/FZHI)*XCYCLE
          XX=ALOG10(FZLO/FMIN)*XCYCLE $IF(XX.LT.WIDTH) GO TO 140
          IF(DHIMAX.LT.WIDTH) GO TO 120
          X1=FMIN $X2=FZLO $X3=FZHI $X4=FMAX
          GO TO 200

      120 X1=FMIN $X4=FZLO $IF(DLOHI.LT.WIDTH) GO TO 180
          X1=FMIN $X2=FZLO $X3=FZLO $X4=FZHI
          GO TO 200

      140 IF(DLOHI.LT.WIDTH) GO TO 160
          X1=FZLO $X4=FZHI
          IF(DHIMAX.LT.WIDTH) GO TO 180
          X1=FZLO $X2=FZHI $X3=FZHI $X4=FZHI
          GO TO 200

      160 IF(DHIMAX.LT.WIDTH) RETURN
          X1=FZHI $X4=FMAX

      180 XX=ALOG10(X4/X1)*XCYCLE $XX=(XX-2.0*WIDTH)/3.0
          X2=ALOG10(X1) $X3=X2+(XX+WIDTH)/XCYCLE $X3=10.0**X3
          X2=X2+(2.0*XX+WIDTH)/XCYCLE $X2=10.0**X2

      200 CALL FFOXBA(FZLO,BLO,XLO,ALO,X1,X2,YVAL,DYVAL,XCYCLE,3,0)
      220 CALL FFOXBA(FZHI,BHI,XHI,AHI,X3,X4,YVAL,DYVAL,XCYCLE,3,1)

          RETURN
          END


SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  LOGFBXA
```

```
      SUBROUTINE LOGFBXA     74/74    OPT=1                              FTN 4.5+414         08/16/77  13.11.28

VARIABLES       SN  TYPE            RELOCATION
    0   AHI          REAL                  F.P.           0   ALO        REAL                F.P.
    0   BHI          REAL                  F.P.           0   BLO        REAL                F.P.
    7   CATGRY       REAL                 PPLOTT        222   DHIMAX     REAL
  223   DLOHI        REAL                                 0   DYVAL      REAL                F.P.
    0   EMAX         REAL                  F.P.           0   EMIN       REAL                F.P.
  221   FZHI         REAL                               220   FZLO       REAL
    0   FZROHI       REAL                  F.P.           0   FZROLO     REAL                F.P.
    0   H            REAL                 PPLOTT         45   HITE       REAL                PPLOTT
   46   HITE1        REAL                 PPLOTT          6   IFLITE     INTEGER             PPLOTT
  206   IHI          INTEGER                             10   ILINE1     INTEGER    ARRAY    PPLOTT
    0   ILOHI        INTEGER               F.P.          55   IPHASE     INTEGER             PPLOTT
   26   IPLANE       INTEGER     ARRAY    PPLOTT         17   ITITL1     INTEGER    ARRAY    PPLOTT
   31   LXNAME       INTEGER     ARRAY    PPLOTT         35   LYNAME     INTEGER    ARRAY    PPLOTT
    3   RS           REAL                 PPLOTT         47   TICLEN     REAL                PPLOTT
    4   WE           REAL                 PPLOTT        217   WIDTH      REAL
    5   WS           REAL                 PPLOTT          2   X          REAL                PPLOTT
   44   XAXIS        REAL                 PPLOTT         41   XCYCLE     REAL                PPLOTT
    0   XHI          REAL                  F.P.           0   XLO        REAL                F.P.
    1   XMAKNO       REAL                 PPLOTT         54   XX         REAL                PPLOTT
   50   X1           REAL                 PPLOTT         51   X2         REAL                PPLOTT
   52   X3           REAL                 PPLOTT         53   X4         REAL                PPLOTT
   43   YAXIS        REAL                 PPLOTT         42   YSTEP      REAL                PPLOTT
    0   YVAL         REAL                  F.P.

EXTERNALS          TYPE    ARGS
      ALOG10       REAL       1 LIBRARY                       FROXBA               11

STATEMENT LABELS
    34  100                            61  120                                          71  140
   102  160                           107  180                                         133  200
   144  220

COMMON BLOCKS    LENGTH
      PPLOTT         46

STATISTICS
   PROGRAM LENGTH                    224B        148
   CM LABELED COMMON LENGTH           56B         46
```

```
SUBROUTINE DBELMAX     74/74    OPT=1                                FTN 4.5+414          08/16/77  13.11.28

                 SUBROUTINE DBELMAX(PEAK,YSTEP,DBMAX)
                 I=PEAK/YSTEP $J=0 $SIGN=-1.0 $IF(PEAK.LT.0.) GO TO 10                   VIPRF     2901
                 J=1 $SIGN=1.0                                                           VIPRF     2902
              10 DBMAX=YSTEP*(I+J)                                                       VIPRF     2903
                 IF(AMOD(PEAK,YSTEP).GT.SIGN*YSTEP/2.) DBMAX=DBMAX+F.                    VIPRF     2904
                 RETURN                                                                  VIPRF     2905
                 END                                                                     VIPRF     2906
                                                                                         VIPRF     2907

SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   DBELMAX

VARIABLES       SN   TYPE             RELOCATION
    0   DBMAX        REAL                 F.P.          35   I          INTEGER
   36   J            INTEGER                             0   PEAK       REAL               F.P.
   37   SIGN         REAL                                0   YSTEP      REAL               F.P.

INLINE FUNCTIONS     TYPE     ARGS
        AMOD         REAL        2   INTRIN

STATEMENT LABELS
   15   10

STATISTICS
  PROGRAM LENGTH                  40B       32
```

```
SUBROUTINE GPOINTS     74/74    OPT=1                                FTN 4.5+414        08/16/77  13.11.28

          SUBROUTINE GPOINTS(FREQ,DECBEL,FRQ,FMAX,CONST,DB,XFERMX,TWOB,FLX,   VIPRF     2908
         1FZ,HILO,SIGN,ALPHA,II,J,K,L)                                        VIPRF     2909
          DIMENSION XFERMX(4),TWOB(4),FZ(4),ALPHA(4),FLX(4)                   VIPRF     2910
          DIMENSION FREQ(1),DECBEL(1),DB(4),DBPRV(4),HILO(4),SIGN(4)          VIPRF     2911
                                                                              VIPRF     2912
       10 DO 20 I=1,K                                                         VIPRF     2913
          IF(L.EQ.I) GO TO 20                                                 VIPRF     2914
          X1=FRQ/FZ(I) $DBPRV(I)=DB(I)                                        VIPRF     2915
          DB(I)=XFERMX(I)+20.*ALOG10((HILO(I)+SIGN(I)*ATAN2(                  VIPRF     2916
         1TWOB(I)*(X1**ALPHA(I)),1.-X1*X1))/FLX(I))                           VIPRF     2917
       20 CONTINUE                                                            VIPRF     2918
                                                                              VIPRF     2919
          X1=DB(1) $X2=DB(2) $X3=DB(3) $X4=DB(4) $ITYPEP=ITYPE                VIPRF     2920
          IF(X1.LE.X2) GO TO 30                                               VIPRF     2921
          IF(X1.LE.X3) GO TO 40                                               VIPRF     2922
          IF(X1.LE.X4) GO TO 50                                               VIPRF     2923
          ITYPE=1 $GO TO 60                                                   VIPRF     2924
                                                                              VIPRF     2925
       30 IF(X2.LE.X3) GO TO 40                                               VIPRF     2926
          IF(X2.LE.X4) GO TO 50                                               VIPRF     2927
          ITYPE=2 $GO TO 60                                                   VIPRF     2928
                                                                              VIPRF     2929
       40 IF(X3.LE.X4) GO TO 50                                               VIPRF     2930
          ITYPE=3 $GO TO 60                                                   VIPRF     2931
                                                                              VIPRF     2932
       50 ITYPE=4                                                             VIPRF     2933
                                                                              VIPRF     2934
                                                                              VIPRF     2935
       60 IF(ITYPE.NE.ITYPEP.AND.II.EQ.0) GO TO 70                            VIPRF     2936
          J=J+1 $FREQ(J)=FRQ $DECBEL(J)=DB(ITYPE) $GO TO 80                   VIPRF     2937
                                                                              VIPRF     2938
       70 X1=DBPRV(ITYPE)-DBPRV(ITYPEP)                                       VIPRF     2939
          FRQ=FPRV+CONST*FPRV*X1/(X1+DB(ITYPEP)-DB(ITYPE))                    VIPRF     2940
          J=J+1 $FREQ(J)=FRQ $X1=FRQ/FZ(ITYPE)                                VIPRF     2941
          X1=XFERMX(ITYPE)+20.*ALOG10((HILO(ITYPE)+SIGN(ITYPE)*               VIPRF     2942
         1ATAN2(TWOB(ITYPE)*(X1**ALPHA(ITYPE)),1.-X1*X1))/FLX(ITYPE))         VIPRF     2943
          DECBEL(J)=X1                                                        VIPRF     2944
                                                                              VIPRF     2945
       80 IF(FRQ.GE.20.0.AND.FRQ.LE.500.0) X1=CONST/2.0                       VIPRF     2946
          IF(FRQ.LT.20.0.OR.FRQ.GT.500.0) X1=CONST                            VIPRF     2947
          FPRV=FRQ                                                            VIPRF     2948
          FRQ=FRQ+X1*FRQ $IF(FRQ.GT.FMAX) RETURN                              VIPRF     2949
          II=0 $GO TO 10                                                      VIPRF     2950
          END                                                                 VIPRF     2951


   SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   GPOINTS

VARIABLES      SN   TYPE              RELOCATION
    0   ALPHA       REAL         ARRAY     F.P.            0   CONST      REAL                     F.P.
    0   DB          REAL         ARRAY     F.P.          206   DBPRV      REAL          ARRAY
```

```
      SUBROUTINE GPOINTS     74/74    OPT=1                                    FTN 4.5+414         08/16/77  13.11.28

VARIABLES       SN  TYPE               RELOCATION
    0  DECBLL      REAL         ARRAY      F.P.           0  FLX        REAL          ARRAY       F.P.
    0  FMAX        REAL                    F.P.         205  FPRV       REAL
    0  FREQ        REAL         ARRAY      F.P.           0  FRQ        REAL                      F.P.
    0  FZ          REAL         ARRAY      F.P.           0  HILO       REAL          ARRAY       F.P.
  176  I           INTEGER                                0  II         INTEGER                   F.P.
  204  ITYPE       INTEGER                              203  ITYPEP     INTEGER
    0  J           INTEGER                 F.P.           0  K          INTEGER                   F.P.
    0  L           INTEGER                 F.P.           0  SIGN       REAL          ARRAY       F.P.
    0  THOP        REAL         ARRAY      F.P.           0  XFERMX     REAL          ARRAY       F.P.
  177  X1          REAL                                 200  X2         REAL
  201  X3          REAL                                 202  X4         REAL

EXTERNALS           TYPE    ARGS
      ALOG10     REAL        1 LIBRARY                        ATAN2      REAL          2 LIBRARY

STATEMENT LABELS
   15  10                                   40  20                                      56  30
   63  40                                   67  50                                      70  60
  104  70                                  146  80

LOOPS  LABEL      INDEX      FROM-TO      LENGTH      PROPERTIES
   16  20       * I            6  11        25B                  EXT REFS

STATISTICS
  PROGRAM LENGTH                      255B       173
```

```
      SUBROUTINE XFERFUN     74/74    OPT=1                         FTN 4.5+414        08/16/77  13.11.28

      SUBROUTINE XFERFUN(FREQ,DECBEL,N,PEAK,XLO,XHI,BLO,BHI,FZEROL,      VIPRF    2952
     1FZEROH,ALO,AHI,ILOHI)                                              VIPRF    2953
      DIMENSION FREQ(1),DECBEL(1)                                        VIPRF    2954
      DATA PI/3.14159265/,IHI/2HHI/                                      VIPRF    2955
      J=1 $IF(ILOHI.EQ.IHI) GO TO 40                                     VIPRF    2956
                                                                         VIPRF    2957
      FMAX=XLO*FZEROL $TWOB=2.*BLO                                       VIPRF    2958
      FLX=ATAN2(TWOB*(XLO**ALO),1.-XLO*XLO)                              VIPRF    2959
                                                                         VIPRF    2960
      DO 10 I=1,N                                                        VIPRF    2961
      J=I $FRQ=FREQ(I) $IF(FRQ.GT.FMAX) GO TO 20                         VIPRF    2962
      X1=FRQ/FZEROL                                                      VIPRF    2963
   10 DECBEL(I)=PEAK+20.*ALOG10(ATAN2(TWOB*(X1**ALO),1.-X1*X1)/FLX)      VIPRF    2964
                                                                         VIPRF    2965
   20 X1=FMAX $FMAX=XHI*FZEROH $IF(X1.EQ.FMAX) GO TO 40                  VIPRF    2966
   30 FRQ=FREQ(J) $IF(FRQ.GT.FMAX) GO TO 40                              VIPRF    2967
      DECBEL(J)=PEAK $J=J+1                                              VIPRF    2968
      GO TO 20                                                           VIPRF    2969
                                                                         VIPRF    2970
   40 TWOB=2.*BHI $FLX=PI-ATAN2(TWOB*(XHI**AHI),1.-XHI*XHI)              VIPRF    2971
                                                                         VIPRF    2972
      DO 50 I=J,N                                                        VIPRF    2973
      FRQ=FREQ(I) $X1=FRQ/FZEROH                                         VIPRF    2974
   50 DECBEL(I)=PEAK+20.*ALOG10((PI-ATAN2(TWOB*(X1**AHI),1.-X1*X1))/FLX) VIPRF    2975
                                                                         VIPRF    2976
      RETURN                                                             VIPRF    2977
      END                                                                VIPRF    2978


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   XFERFUN

VARIABLES       SN   TYPE             RELOCATION
     0   AHI         REAL                   F.P.        0   ALO      REAL                F.P.
     0   BHI         REAL                   F.P.        0   BLO      REAL                F.P.
     0   DECBEL      REAL        ARRAY      F.P.      135   FLX      REAL
   133   FMAX        REAL                               0   FREQ     REAL       ARRAY    F.P.
   137   FRQ         REAL                               0   FZEROH   REAL                F.P.
     0   FZEROL      REAL                   F.P.      136   I        INTEGER
   126   IHI         INTEGER                            0   ILOHI    INTEGER             F.P.
   132   J           INTEGER                            0   N        INTEGER             F.P.
     0   PEAK        REAL                   F.P.      125   PI       REAL
   134   TWOB        REAL                               0   XHI      REAL                F.P.
     0   XLO         REAL                   F.P.      140   X1       REAL

EXTERNALS            TYPE    ARGS
      ALOG10         REAL      1 LIBRARY                  ATAN2      REAL       2 LIBRARY

STATEMENT LABELS
     0  10                          54  20                               0  30          INACTIVE
    70  40                           0  50
```

```
      SUBROUTINE XFERFUN     74/74    OPT=1                               FTN 4.5+414         08/16/77  13.11.28

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
   33  10       * I            10 13       21B                 EXT REFS     EXITS
  103  50       * I            22 24       20B                 EXT REFS

STATISTICS
  PROGRAM LENGTH                 177B       127
```

```
SUBROUTINE PARAMS      74/74    OPT=1                          FTN 4.5+414        08/16/77   13.11.28

      SUBROUTINE PARAMS(XVAL,YVAL,DYVAL,XMAKNO,H,DISTFT,JX,RS,IFLITE,   VIPRF    2979
     1HITE,HITE1)                                                        VIPRF    2980
      CALL HEIGHT(HITE1)                                                 VIPRF    2981
      CALL RLMESS("(M)=$",+100,XVAL,YVAL)                                VIPRF    2982
      CALL FLREAL(XMAKNO,+2,"ABUT","ABUT")                               VIPRF    2983
      CALL RLMESS("(H)=$",+100,XVAL,YVAL-DYVAL)                          VIPRF    2984
      II=H $CALL INTNO(II,"ABUT","ABUT")                                 VIPRF    2985
      CALL RLMESS(" FT.$",+100,"ABUT","ABUT")                            VIPRF    2986
      CALL RLMESS("(X) =$",+100,XVAL,YVAL-2.0*DYVAL)                     VIPRF    2987
      CALL FLREAL(DISTFT,1,"ABUT","ABUT")                                VIPRF    2988
      CALL RLMESS(" FT.$",+100,"ABUT","ABUT")                            VIPRF    2989
      CALL RLMESS(JX,+100,XVAL,YVAL-2.5*DYVAL)                           VIPRF    2990
      CALL RLMESS("(R) =$",+100,XVAL,YVAL-3.5*DYVAL)                     VIPRF    2991
      CALL FLREAL(RS,+1,"ABUT","ABUT")                                   VIPRF    2992
      CALL RLMESS(" IN.$",+100,"ABUT","ABUT")                            VIPRF    2993
      CALL RLMESS(" S $",+100,XVAL,YVAL-4.0*DYVAL)                       VIPRF    2994
      CALL RESET("BASALF")                                               VIPRF    2995
      CALL RLMESS(IFLITE,10,XVAL,YVAL -5.0*DYVAL)                        VIPRF    2996
      CALL BASALF("L/CSTD")                                              VIPRF    2997
      CALL HEIGHT(HITE)                                                  VIPRF    2998
      RETURN                                                             VIPRF    2999
      END                                                                VIPRF    3000
```

```
SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  PARAMS

VARIABLES       SN   TYPE              RELOCATION
     0  DISTFT      REAL                  F.P.          0  DYVAL      REAL                F.P.
     0  H           REAL                  F.P.          0  HITE       REAL                F.P.
     0  HITE1       REAL                  F.P.          0  IFLITE     INTEGER             F.P.
   260  II          INTEGER                             0  JX         INTEGER             F.P.
     0  RS          REAL                  F.P.          0  XMAKNO     REAL                F.P.
     0  XVAL        REAL                  F.P.          0  YVAL       REAL                F.P.

EXTERNALS             TYPE    ARGS
      BASALF                    1                        HEIGHT             1
      INTNO                     3                        RESET              1
      RLMESS                    4                        FLREAL             4

STATISTICS
  PROGRAM LENGTH                    341B     225
```

```
      SUBROUTINE TABLE       74/74    OPT=1                              FTN 4.5+414        08/16/77  13.11.28

                     SUBROUTINE TABLE(FREQ,DB,N,IFUN,ISCRPT)                               VIPRF      3001
                     DIMENSION FREQ(1),DB(1)                                               VIPRF      3002
                     PRINT 10,IFUN,IFUN,IFUN,IFUN,ISCRPT,ISCRPT,ISCRPT,ISCRPT              VIPRF      3003
                  10 FORMAT(1H-,* FREQ.(HZ.)*,2X,A10,3(14X,*FREQ.(HZ.)*,2X,A10)/           VIPRF      3004
                    116X,A2,3(34X,A2))                                                     VIPRF      3005
                     NLINES=N/4 $LINPRT=MOD(N,4)                                           VIPRF      3006
                                                                                           VIPRF      3007
                     DO 20 I=1,NLINES                                                      VIPRF      3008
                     I1=I+NLINES $I2=I1+NLINES $I3=I2+NLINES                               VIPRF      3009
                  20 PRINT 30,FREQ(I),DB(I),FREQ(I1),DB(I1),FREQ(I2),DB(I2),FREQ(I3),      VIPRF      3010
                    1DB(I3)                                                                VIPRF      3011
                  30 FORMAT(F10.1,F12.2,3(F24.1,F12.2))                                    VIPRF      3012
                                                                                           VIPRF      3013
                     IF(LINPRT.EQ.0) RETURN                                                VIPRF      3014
                                                                                           VIPRF      3015
                     NLINES=N-LINPRT+1                                                     VIPRF      3016
                                                                                           VIPRF      3017
                     DO 40 I=NLINES,N                                                      VIPRF      3018
                  40 PRINT 50,FREQ(I),DB(I)                                                VIPRF      3019
                  50 FORMAT(106X,F12.1,F12.2)                                              VIPRF      3020
                                                                                           VIPRF      3021
                     RETURN                                                                VIPRF      3022
                     END                                                                   VIPRF      3023


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   TABLE

VARIABLES       SN  TYPE              RELOCATION
    0   DB          REAL        ARRAY      F.P.            0   FREQ       REAL        ARRAY       F.P.
  143   I           INTEGER                                0   IFUN       INTEGER                 F.P.
    0   ISCRPT      INTEGER                F.P.          144   I1         INTEGER
  145   I2          INTEGER                              146   I3         INTEGER
  142   LINPRT      INTEGER                                0   N          INTEGER                 F.P.
  141   NLINES      INTEGER

FILE NAMES          MODE
        OUTPUT      FMT

INLINE FUNCTIONS     TYPE     ARGS
        MOD         INTEGER     2   INTRIN

STATEMENT LABELS
  102   10          FMT                          0   20                                 125   30        FMT
    0   40                                     136   50       FMT

LOOPS   LABEL     INDEX       FROM-TO      LENGTH      PROPERTIES
   24   20        * I            9  13        25B                 EXT REFS
   55   40        * I           16  19        11B                 EXT REFS

STATISTICS
  PROGRAM LENGTH                 171B      121
```

```
      SUBROUTINE TICKMK      74/74    OPT=1                         FTN 4.5+414        08/16/77  13.11.28

 1                  SUBROUTINE TICKMK(TICLEN,FMAX,YSTEP,YAXIS,DBMIN)                   VIPRF    3024
                    DIMENSION FREQ(2),DECBEL(2)                                        VIPRF    3025
                                                                                       VIPRF    3026
                    X1=ALOG10(FMAX) $X2=X1-2.5*TICLEN $X1=X1-TICLEN                    VIPRF    3027
 5                  X1=10.**X1 $X2=10.**X2                                             VIPRF    3028
                      DBMAX=DBMIN+YSTEP*YAXIS $DB=DBMIN $DELDB=YSTEP/5.                VIPRF    3029
                    FREQ(1)=FMAX $FREQ(2)=FMAX $DECBEL(1)=DBMIN $DECBEL(2)=DBMAX       VIPRF    3030
                    CALL CURVE(FREQ,DECBEL,2,0)                                        VIPRF    3031
                                                                                       VIPRF    3032
 10              10 DB=DB+DELDB                                                        VIPRF    3033
                    IF(DB.GT.DBMAX) RETURN                                             VIPRF    3034
                    FREQ(1)=X1 $IF(AMOD(DB,YSTEP).EQ.0.) FREQ(1)=X2                    VIPRF    3035
                    DECBEL(1)=DB $DECBEL(2)=DB                                         VIPRF    3036
                    CALL CURVE(FREQ,DECBEL,2,0)                                        VIPRF    3037
 15                 GO TO 10                                                           VIPRF    3038
                                                                                       VIPRF    3039
                    RETURN                                                             VIPRF    3040
                    END                                                                VIPRF    3041


CARD NO. SEVERITY  DETAILS     DIAGNOSIS OF PROBLEM

     17     I                 THERE IS NO PATH TO THIS STATEMENT.



      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3   TICKMK

 VARIABLES       SN  TYPE              RELOCATION
    66   DB            REAL                                    65   DBMAX       REAL
     0   DBMIN         REAL                   F.P.             72   DECBEL      REAL          ARRAY
    67   DELDB         REAL                                     0   FMAX        REAL                        F.P.
    70   FREQ          REAL          ARRAY                      0   TICLEN      REAL                        F.P.
    63   X1            REAL                                    64   X2          REAL
     0   YAXIS         REAL                   F.P.              0   YSTEP       REAL                        F.P.

 EXTERNALS            TYPE     ARGS
        ALOG10        REAL        1 LIBRARY                      CURVE                   4

 INLINE FUNCTIONS     TYPE     ARGS
        AMOD          REAL        2   INTRIN

 STATEMENT LABELS
    31   10

 STATISTICS
   PROGRAM LENGTH                    74B        60
```

```
SUBROUTINE FROXBA       74/74    OPT=1                          FTN 4.5+414        08/16/77  13.11.28

                SUBROUTINE FROXBA(FZERO,BETA,X,ALPHA,F1,F2,Y,DY,XCYCLE,NXPLAC,        VIPRF    3042
               1IPRIME)                                                               VIPRF    3043
                DATA WIDTH/1.25/                                                      VIPRF    3044
                                                                                      VIPRF    3045
                XX=ALOG10(F2/F1)*XCYCLE $XX=(XX-WIDTH)/2.0                            VIPRF    3046
                XX=ALOG10(F1)+XX/XCYCLE $XX=10.0**XX                                  VIPRF    3047
                IF=3HF = $IX=3HX = $IB=3HB = $IA=3HA =                                VIPRF    3048
                IF(IPRIME.EQ.0) GO TO 10                                              VIPRF    3049
                IF=3HF'= $IX=3HX'= $IB=3HB'= $IA=3HA'=                                VIPRF    3050
                                                                                      VIPRF    3051
             10 CALL PLMESS(IF,3,XX,Y)                                                VIPRF    3052
                CALL PLREAL(FZERO,1,"ABUT","ABUT")                                    VIPRF    3053
                CALL PLMESS(" (HZ)",+100,"ABUT","ABUT")                               VIPRF    3054
                CALL PLMESS(" DB",+100,XX,Y-0.5*DY)                                   VIPRF    3055
                CALL PLMESS(IX,3,XX,Y-1.5*DY)                                         VIPRF    3056
                CALL PLREAL(X,NXPLAC,"ABUT","ABUT")                                   VIPRF    3057
                CALL PASALF("L/CGPEEK")                                               VIPRF    3058
                CALL PLMESS(IB,3,XX,Y-2.5*DY)                                         VIPRF    3059
                CALL PLREAL(BETA,3,"ABUT","ABUT")                                     VIPRF    3060
                CALL PLMESS(IA,3,XX,Y-3.5*DY)                                         VIPRF    3061
                CALL PLREAL(ALPHA,2,"ABUT","ABUT")                                    VIPRF    3062
                CALL PASALF("L/CSTD")                                                 VIPRF    3063
                                                                                      VIPRF    3064
                RETURN                                                                VIPRF    3065
                END                                                                   VIPRF    3066


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
     3   FROXBA

VARIABLES    SN   TYPE              RELOCATION
     0   ALPHA      REAL                 F.P.            0   BETA       REAL              F.P.
     0   DY         REAL                 F.P.            0   FZERO      REAL              F.P.
     0   F1         REAL                 F.P.            0   F2         REAL              F.P.
   231   IA         INTEGER                            230   IB         INTEGER
   226   IF         INTEGER                              0   IPRIME     INTEGER           F.P.
   227   IX         INTEGER                              0   NXPLAC     INTEGER           F.P.
   223   WIDTH      REAL                                 0   X          REAL              F.P.
     0   XCYCLE     REAL                 F.P.          225   XX         REAL
     0   Y          REAL                 F.P.

EXTERNALS        TYPE     ARGS
       ALOG10     REAL       1 LIBRARY                  PASALF              1
       PLMESS                4                          PLREAL              4

STATEMENT LABELS
    36   10

STATISTICS
  PROGRAM LENGTH                    266B       182
```

```
      SUBROUTINE BETA        74/74    OPT=1                          FTN 4.5+414         08/16/77  13.11.28

                  SUBROUTINE BETA(B,PEAK,SPLVAL,X,ALPHA,FREQ,FZERO,SGN,HILO)             VIPRF     3067
                                                                                         VIPRF     3068
                  FBETA(XX,PEAK,SPLVAL,X,ALPHA,FREQ,FZERO,SGN,HILO)=                     VIPRF     3069
                 1(10.0**((SPLVAL-PEAK)/20.0))*                                          VIPRF     3070
                 2(HILO+SGN*ATAN2(2.0*XX*X**ALPHA,1.0-X*X))-                             VIPRF     3071
                 3(HILO+SGN*ATAN2(2.0*XX*(FREQ/FZERO)**ALPHA,                            VIPRF     3072
                 41.0-(FREQ/FZERO)*(FREQ/FZERO)))                                        VIPRF     3073
                                                                                         VIPRF     3074
                  BPRV=1.0 $DELB=0.05                                                    VIPRF     3075
                  FPRV=FBETA(BPRV,PEAK,SPLVAL,X,ALPHA,FREQ,FZERO,SGN,HILO)               VIPRF     3076
                  B=BPRV+DELB                                                            VIPRF     3077
                  F=FBETA(B,PEAK,SPLVAL,X,ALPHA,FREQ,FZERO,SGN,HILO)                     VIPRF     3078
                  IF(FPRV*F.LE.0.) GO TO 30                                              VIPRF     3079
                  IF(ABS(FPRV).GT.ABS(F)) GO TO 10                                       VIPRF     3080
                  DELB=-DELB $B=BPRV $F=FPRV                                             VIPRF     3081
                                                                                         VIPRF     3082
               10 BPRV=B $FPRV=F $B=B+DELB                                               VIPRF     3083
                  F=FBETA(B,PEAK,SPLVAL,X,ALPHA,FREQ,FZERO,SGN,HILO)                     VIPRF     3084
                  IF(FPRV*F.GT.0.) GO TO 10                                              VIPRF     3085
                                                                                         VIPRF     3086
               30 B=(BPRV*F-B*FPRV)/(F-FPRV)                                             VIPRF     3087
                  RETURN                                                                 VIPRF     3088
                  END                                                                    VIPRF     3089


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   BETA

VARIABLES       SN   TYPE              RELOCATION
    0   ALPHA        REAL                   F.P.        0   B            REAL                     F.P.
  157   BPRV         REAL                             160   DELB         REAL
  162   F            REAL                             161   FPRV         REAL
    0   FREQ         REAL                   F.P.        0   FZERO        REAL                     F.P.
    0   HILO         REAL                   F.P.        0   PEAK         REAL                     F.P.
    0   SGN          REAL                   F.P.        0   SPLVAL       REAL                     F.P.
    0   X            REAL                   F.P.

EXTERNALS            TYPE     ARGS
        ATAN2        REAL       2 LIBRARY

INLINE FUNCTIONS     TYPE     ARGS
        ABS          REAL       1  INTRIN                   FBETA        REAL         9     SF

STATEMENT LABELS
  103   10                               143   30

STATISTICS
  PROGRAM LENGTH                 163B       115
```

```
SUBROUTINE TERPLIN     74/74    OPT=1                                FTN 4.5+414          08/16/77  13.11.28

              SUBROUTINE TERPLIN(X,DELX,XINIT,XARRAY,IXARAY,Y,YARRAY,N)         VIPRF     3090
                                                                                VIPRF     3091
              DIMENSION XARRAY(1),YARRAY(1)                                     VIPRF     3092
                                                                                VIPRF     3093
              IF(IXARAY.EQ.1) GO TO 100                                         VIPRF     3094
                                                                                VIPRF     3095
              I=(X-XINIT)/DELX $XI=I                                            VIPRF     3096
              Y=YARRAY(I+1)+(X-XINIT-XI*DELX)*(YARRAY(I+2)-YARRAY(I+1))/DELX    VIPRF     3097
              RETURN                                                            VIPRF     3098
                                                                                VIPRF     3099
                                                                                VIPRF     3100
          100 DO 110 I=1,N                                                      VIPRF     3101
              J=I $IF(XARRAY(I).GE.X) GO TO 120                                 VIPRF     3102
          110 CONTINUE                                                          VIPRF     3103
                                                                                VIPRF     3104
          120 IF(XARRAY(J).NE.X) GO TO 130                                      VIPRF     3105
              Y=YARRAY(J) $RETURN                                               VIPRF     3106
                                                                                VIPRF     3107
          130 Y=YARRAY(J-1)+                                                    VIPRF     3108
             1(X-XARRAY(J-1))*(YARRAY(J)-YARRAY(J-1))/(XARRAY(J)-XARRAY(J-1))   VIPRF     3109
                                                                                VIPRF     3110
              RETURN                                                            VIPRF     3111
              END                                                               VIPRF     3112
```

```
SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  TERPLIN

VARIABLES     SN  TYPE             RELOCATION
    0  DELX       REAL                   F.P.          61  I          INTEGER
    0  IXARAY     INTEGER                F.P.          63  J          INTEGER
    0  N          INTEGER                F.P.           0  X          REAL                  F.P.
    0  XARRAY     REAL        ARRAY      F.P.          62  XI         REAL
    0  XINIT      REAL                   F.P.           0  Y          REAL                  F.P.
    0  YARRAY     REAL        ARRAY      F.P.

STATEMENT LABELS
   31  100                                 0  110                                  40  120
   47  130

LOOPS   LABEL    INDEX     FROM-TO    LENGTH    PROPERTIES
   32   110    * I          12 14        6B      INSTACK     EXITS

STATISTICS
  PROGRAM LENGTH                    1043       68
```

```
  SUBROUTINE QUAD        74/74    OPT=1                          FTN 4.5+414          08/16/77  13.11.28

                      SUBROUTINE QUAD(X,DELX,XINITL,Y,YVALS,N)                     VIPRF    3113
                      DIMENSION YVALS(1)                                           VIPRF    3114
                                                                                   VIPRF    3115
                      XI=(X-XINITL)/DELX $I=XI $XI=I                               VIPRF    3116
                      X1=XINITL+XI*DELX $XX1=X-X1                                  VIPRF    3117
                                                                                   VIPRF    3118
                      I=I+1 $IF(XX1.NE.0.) GO TO 10                                VIPRF    3119
                      Y=YVALS(I) $RETURN                                           VIPRF    3120
                                                                                   VIPRF    3121
                   10 X3=X1+DELX $K=I+1 $IF(I.NE.1) GO TO 20                       VIPRF    3122
                      X2=X3+DELX $J=K+1 $GO TO 30                                  VIPRF    3123
                                                                                   VIPRF    3124
                   20 X2=X1-DELX $J=I-1                                            VIPRF    3125
                                                                                   VIPRF    3126
                   30 XX2=X-X2 $XX3=X-X3                                           VIPRF    3127
                      X1X2=X1-X2 $X1X3=X1-X3 $X2X3=X2-X3                           VIPRF    3128
                      Y=XX2*XX3*YVALS(I)/(X1X2*X1X3)-XX1*XX3*YVALS(J)/(X1X2*X2X3)+ VIPRF    3129
                     1XX1*XX2*YVALS(K)/(X1X3*X2X3)                                 VIPRF    3130
                      RETURN                                                       VIPRF    3131
                      END                                                          VIPRF    3132


  SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   QUAD

VARIABLES       SN  TYPE             RELOCATION
    0  DELX         REAL                     F.P.          62  I          INTEGER
   70  J            INTEGER                                66  K          INTEGER
    0  N            INTEGER    *UNUSED       F.P.           0  X          REAL                 F.P.
   61  XI           REAL                                    0  XINITL     REAL                 F.P.
   64  XX1          REAL                                   71  XX2        REAL
   72  XX3          REAL                                   63  X1         REAL
   73  X1X2         REAL                                   74  X1X3       REAL
   67  X2           REAL                                   75  X2X3       REAL
   65  X3           REAL                                    0  Y          REAL                 F.P.
    0  YVALS        REAL       ARRAY         F.P.

STATEMENT LABELS
   21  10                             31  20                                  36  30

STATISTICS
  PROGRAM LENGTH                   76B      62
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